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THE PRINCIPLES
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of
COST ACCOUNTI[illegible]

VERIFIED
JUNE, 72

WALTER SCOTT, [illegible].A., [illegible]A.A., F.A.I.S.
Consult[illegible] Cost [illegible]

"Business [illegible] Control."

[illegible]ITION.

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ACKNOWLEDGMENTS.

Some of the material contained in Part I of this volume appeared in synopses prepared by me in connection with the Post Graduate Courses Lectures in Cost Accounting which I delivered in the years 1939 to 1941 Permission to use this data was readily given to me by the N.S.W. State Council of the Commonwealth Institute of Accountants.

It is desired also to acknowledge the assistance which has been given to me at various times during the writing of this book, by colleagues in my own firm, Mr. W. Spooner and Mr. A. Ingham, and also by Mr. E. S. Jackson, my chief assistant in the Ministry of Munitions. In addition, I wish to express special thanks to Mr. G. H. Peterson, also of the Ministry of Munitions, who not only checked many of the calculations in this book, but made a critical survey of certain sections, notably Part 2 dealing with Standard Costs. His criticism I found extremely helpful and I included some of his suggestions.

In the course of preparation of the text, extracts have been made from the following publications and the author desires to give recognition and thanks accordingly: Alford's "Principles of Industrial Management" (Ronald Press); Anderson, Mandeville & Anderson's "Industrial Management" (Ronald Press); Barnes' "Motion and Time Study" (John Wiley & Sons); Gilbreth's "Applied Motion Study" (George Routledge & Sons); Kester's "Advanced Accounting" (Ronald Press); "Modern Shop Practice," American Technical Society; Rorem's "Accounting Method" (University of Chicago Press). If additional information on the subjects dealt with in those quotations is desired the reader will be well advised to make a study of the publications referred to.

Finally, I wish to express my deep appreciation of the assistance rendered to me by my wife, without whose aid this book would not have been possible.

W.S.

PREFACE TO SECOND EDITION.

The first printing of "Principles and Practice of Cost Accounting" was made in 1944 whilst this country was at war, and owing to the prevailing shortage of paper the number printed had to be curtailed. The widespread demand has necessitated a further printing and the opportunity has been taken to correct a few minor printer's errors and to exclude the Appendix which was devoted entirely to the costing of munitions contracts and the preparation for post-war conditions. The termination of the war has obviated the need for this information.

In 1944 it was difficult to foretell specifically the conditions of the post-war economy, but it was evident that management would be faced with many problems.

The war has now ended and the pattern of post-war conditions whilst still somewhat blurred, is beginning to take shape. Some of the difficulties we foresaw have not eventuated whilst others have assumed an importance much greater than anticipated.

The ending of the war has brought closer the solemn obligation upon Australian Industry to aim at maximum efficiency. Not only will this result in reduced costs and the advantages associated therewith, but it will ensure that Australian Industry will be in a position to compete with the outside world at least in Australia, and possibly in export markets. There is no substitute for efficiency and it will require high calibre management.

The demand for maximum efficiency will necessitate highly effective Cost Accounting, to provide management with information which will enable it to control and direct more efficiently.

It is not sufficient, however, for the Cost Accountant merely to prepare reports. He must be able to analyse their meaning, to interpret their results and suggest their implications—in the language of management, if need be, not just in accounting terms. Moreover, management will expect these functions to be carried out with a commendable standard of technical skill, with a sound knowledge of requirements and with a wise application of accounting controls—all moulded perhaps to suit the economic background and environment in which business must operate.

The post-war world is bringing additional development and wider recognition of Standard Costs and Budgetary Control. Considerable progress can be expected in the field of distribution and this promises to be one of the most striking features of our post-war economy.

It is imperative that the Cost Accountant should be equipped to take up this challenge and this opportunity. The general accounting knowledge necessary to enable him to pass the examinations of one of the recognised accounting institutes is but the foundation upon which he must build that specialised knowledge which alone can give him the perception and judgment he must constantly exercise.

If Cost Accountants are prepared to apply themselves with diligence, with fidelity, with keen and searching intellects, with initiative, and, above all, with keen insight into the needs of management, to the tasks which lie ahead, they can make a substantial contribution to the development of a soundly based post-war economy. The role of the Cost Accountant will probably be more important in the future than ever before, but failure to meet this responsibility will be more disastrous. Conversely, success in measuring up to these obligations will be more fruitful.

It is hoped that this book may be of assistance in teaching the principles and practice of Cost Accounting methods and procedure in relation to industrial activities.

It is felt that the book covers practically the full field of knowledge usually required by the Cost Accountant with the exception of Statistical Analysis (including the use of graphs). This has not been attempted primarily because this subject has already been covered in " Statistical Methods as Applied to Accounting Reports " by A. A. Fitzgerald, B.Com., F.I.C.A., F.A.I.S. Readers are confidently referred to that publication.

Some of the subjects included in this book on Cost Accounting bear some relationship to Managerial Accounting but no attempt has been made to draw a dividing line between Cost and Managerial Accounting. It is felt that to do so would necessitate inclusion of an exhaustive survey of the whole managerial accounting field. Similarly no distinction has been made between the cost and the managerial accountant.

This post-war field upon which we have entered, will demand of Cost Accountants a much higher standard of knowledge and an appreciation of the Managerial aspects of Cost Accounting. As this book is based upon practical experience in Australian Industry, it is hoped that it will be found of value in imparting knowledge and stimulating further interest in the subject.

WALTER SCOTT.

Sydney,
November, 1946.

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PART 1.

GENERAL COST ACCOUNTING.

CHAPTER 1.

THE SCOPE OF COST ACCOUNTING.

Preliminary Observations.

Cost terminology is often loosely applied and it is desirable at the outset, therefore, that the exact meaning of various costing terms should be precisely determined.

(a) *Cost* may be defined as that which is given or is sacrificed to obtain something. The cost of an article can consist of actual outgoings or ascertained charges incurred in its production and sale. This would represent the cost to make and sell, but because of varieties of meaning, it is always advisable to qualify the word "Cost" to show exactly what is meant, e.g., prime cost, factory cost, etc.

(b) *Cost Accounting* is a branch of General Accounting, and covers the application of accounting principles relating to the tracking, recording, classifying and analysing of costs within the organization. The term was initially confined to manufacturing costs, but now administrative, financial and distribution costs are included. Cost Accountancy is an alternative term for Cost Accounting.

(c) *Cost Control Accounts* are those through which control is exercised over all expenditures charged to various costs. Generally such control is exercised in two ways:—

1. The detailed costs of individual articles, orders or processes must be reconciled with the totals of materials, labour and expenses affecting such; and
2. The totals of all detailed costs must be reconciled with the totals of all expenditures as disclosed in the general accounting records.

(See Figures 1 and 2.)

Distinction Between General Accounting and Cost Accounting.

1. *General Accounting* deals with what may be termed the external transactions of the business—dealings with the world outside. It shows (a) outlays for materials, labour and expense, on the one hand, and (b) income from sales on the other.
2. *Cost Accounting* deals with the whole range of internal transactions which are to be found between 1(a) and 1(b). It is analytical, takes up the expenditures shown in the general accounting records, and relates them to the manufacturing and selling processes and operations they are designed to accomplish.

(See Figures 3 and 4.)

Cost Accounting therefore provides at least three things:—

1. A more adequate classification, analysis and study of expenditure.

FIGURE No. 1.

COST CONTROL ACCOUNTS—JOB COSTS.

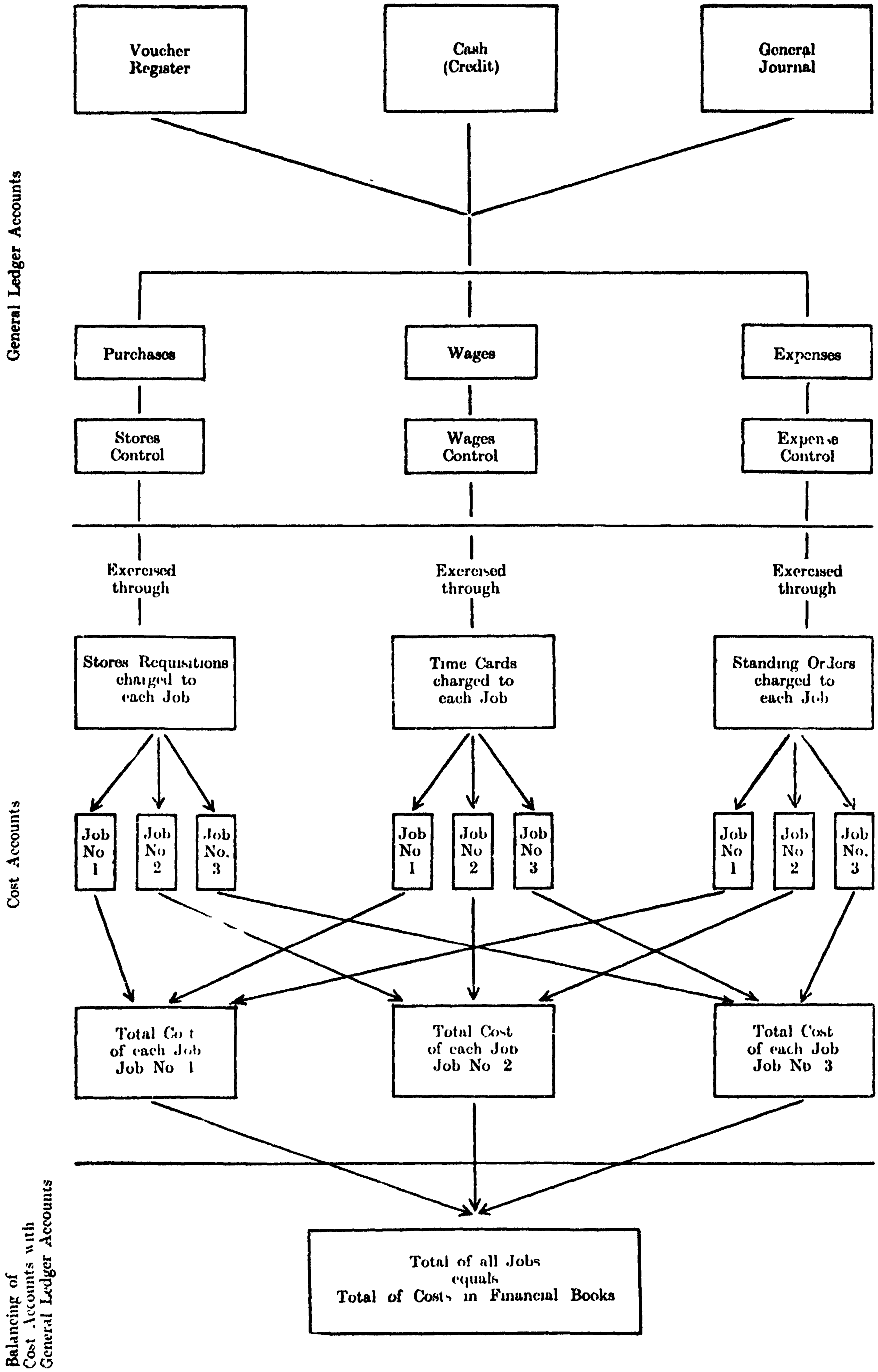
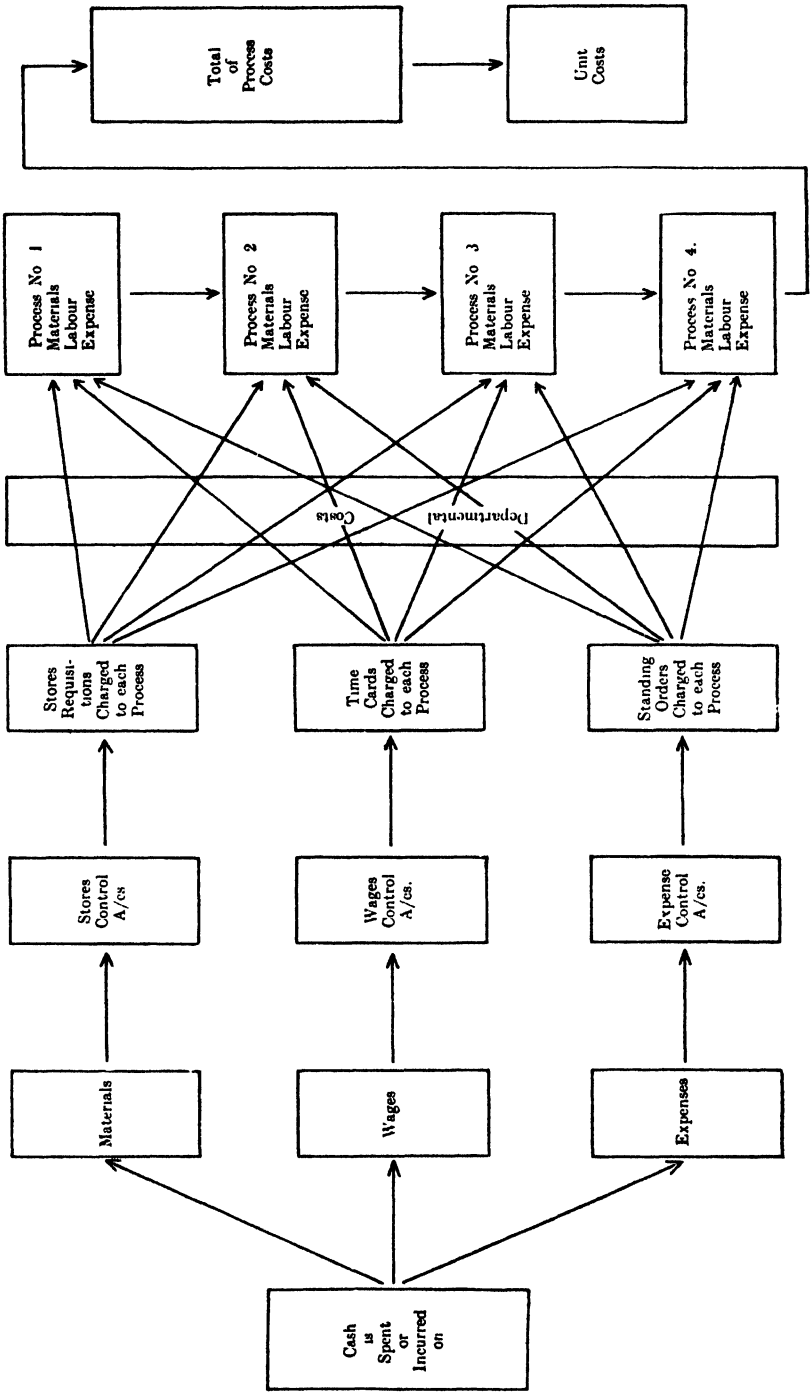

General Ledger Accounts
Voucher Register
Cash (Credit)
General Journal
Purchases
Wages
Expenses
Stores Control
Wages Control
Expense Control
Exercised through
Exercised through
Exercised through
Stores Requisitions charged to each Job
Time Cards charged to each Job
Standing Orders charged to each Job
Cost Accounts
Job No 1
Job No 2
Job No. 3
Job No 1
Job No 2
Job No 3
Job No 1
Job No 2
Job No. 3
Total Cost of each Job Job No 1
Total Cost of each Job Job No 2
Total Cost of each Job Job No 3
Balancing of Cost Accounts with General Ledger Accounts
Total of all Jobs equals Total of Costs in Financial Books

FIGURE No 2

COST CONTROL ACCOUNTS-PROCESS COSTS.


Cash is Spent or Incurred on
Materials
Wages
Expenses
Stores Control A/cs
Wages Control A/cs.
Expense Control A/cs.
Stores Requisitions Charged to each Process
Time Cards Charged to each Process
Standing Orders Charged to each Process
Departmental Costs
Process No 1 Materials Labour Expense
Process No 2 Materials Labour Expense
Process No 3 Materials Labour Expense
Process No 4. Materials Labour Expense
Total of Process Costs
Unit Costs

2. The accurate determination of cost in terms of units.
3. The preparation of Profit and Loss Account and Balance Sheet without a physical stocktaking.

FIGURE No. 3.

THE DEVELOPMENT OF COST ACCOUNTING.

First Stage.—The Financial Books show:—

(a) CONDENSED TRADING AND PROFIT AND LOSS ACCOUNT.

Net Sales	£50,000
Less Cost of Goods Sold	30,000
Gross Profit on Sales	£20,000
Less Selling and Administrative Expenses	14,000
Net Profit	£6,000

(b) TRADING ACCOUNT.

July 1, 1936—	£	June 30, 1937—	£
To Stock on Hand	16,000	By Sales	50,000
June 30, 1937—		„ Stock on Hand	17,000
To Purchases	14,000		
„ Wages	11,000		
„ Manufacturing Expenses	6,000		
„ Gross Profit — Transferred to P. & L. A/c.	20,000		
	£67,000		£67,000

Second Stage.—Analysis of Costs Shows:—

(c) STATEMENT OF COST OF GOODS MANUFACTURED.

Direct Materials.

1/7/36	Raw materials as at	£5,000		
1/7/36	Materials in Process	1,500		
30/6/37	Materials Purchased	12,000		
			£18,500	
„	Less Materials on hand	£4,000		
	„ Materials in Process	2.000		
			6,000	
				£12,500

Direct Labour.

1/7/36	Labour in Process	£1,000		
30/6/37	Labour Charged to Production	9,000		
			£10,000	
„	Less Labour in Process	£1,250		
			1,250	
				£8,750

Factory Expenses.

1/7/36	Factory Expense in Process	£500		
30/6/37	Direct Factory Expenses Charged to Production	6,000		
30/6/37	Indirect Expense Applied	£4,000		
			£10,500	
„	Less Factory Expense in Process	£750		
			750	
				£9,750
	Cost of Goods Manufactured			£31,000

(d) STATEMENT OF COST OF SALES.

1/7/36	Finished Goods Inventory	£8,000
30/6/37	Add Cost of Goods Manufactured	31,000
		39,000
30/6/37	Less Finished Goods Inventory	9,000
	Cost of Sales	£30,000

Third Stage.—An Analysis of Product Costs Shows:—

(e) COMPARATIVE STATEMENT OF GROSS PROFIT ON PRODUCTS.

	No. 1	No. 2	No. 3	No. 4	Total
Net Sales	£23,000	£7,000	£10,000	£10,000	£50,000
Cost of Goods Sold	11,000	3,000	4,000	12,000	30,000
Gross Profit or Loss	£12,000	£4,000	£6,000	L.£2,000	£20,000

Fourth Stage.—An Analysis of Batch Costs Shows:—

(f) COMPARATIVE STATEMENT OF GROSS PROFIT ON FOUR MANUFACTURING BATCHES OF PRODUCT No. 4.

	First.	Second.	Third.	Fourth.	Total.
Material	£950	£950	£1,200	£1,200	£4,300
Labour	1,000	1,500	1,500	1,500	5,500
Expense	300	550	550	800	2,200
Cost of Goods Sold	2,250	3,000	3,250	3,500	12,000
Sales	2,500	2,500	2,500	2,500	10,000
Gross Profit or Loss	£250	L.£500	L.£750	L.£1,000	L.£2,000

FIGURE No. 4.

COMPARATIVE STATEMENT OF EXPENSES.

	January	Unit Cost	February	Unit Cost	March	Unit Cost	Total Jan./Mch.	Average Unit Cost Jan./Mch.	April	Unit Cost
Materials	£20,000	£2	£19,000	£2	£21,000	£2	£60,000	£2	£22,200	£2.018
Labour—Direct	£16,000	£1.6	£15,750	£1.658	£16,750	£1.595	£48,500	£1.617	£18,000	£1.636
Labour—Indirect	£3,250	£ .325	£3,125	£ .329	£3,400	£ .323	£9,775	£ .325	£3,600	£ .327
Repairs & Maintenance	£1,960	£ .196	£2,200	£ .232	£2,300	£ .219	£6,460	£ .215	£2,000	£ .182
General Factory Expense	£1,640	£ .164	£1,680	£ .177	£1,800	£ .171	£5,120	£ .171	£2,300	£ .209
Power and Lighting	£870	£ .087	£860	£ .090	£900	£ .086	£2,630	£ .087	£1,000	£ .091
Total Units M'factured	10,000	£4.372	9,500	£4.486	10.500	£4.394	30,000	£4.415	11,000	£4.463

CHAPTER 2.

COST ACCOUNTING IN RELATION TO MANUFACTURING.

Elements of Cost.

An element may be defined as a component or essential part of anything. The elements of manufacturing costs are:—

1. The purchase price of the materials.
2. The cost of labour.
3. The value of other disbursements necessary to manufacture the product.

These are generally referred to as:—

1. Materials.
2. Labour.
3. Expense.

They can be further divided into:—

Direct Materials,
Direct Labour,
Direct Expense,
and
Indirect Materials,
Indirect Labour,
Indirect Expense.

Direct Materials, Labour and Expense are those items of expenditure which can be reasonably clearly identified with a particular productive unit or department.

Direct Materials and Labour are normal elements, but Direct Expense may be uncommon. The following would, however, be examples of Direct Expense applicable to a particular job:—

(a) *Additional payment for overtime*—
  (i) Where the overtime was contemplated when the order was accepted and allowance was therefore made in the price.
  (ii) Where the overtime was worked at the request of the customer, who agreed to pay the extra cost.

(b) *Cost of patterns and drawings*—
  (i) Where the patterns and drawings were produced for a specific job and totally consumed therein.
  (ii) Where the patterns and drawings were produced for the specific job and there is no reasonable expectancy that future use could be made of them.

(c) *Cost of experimental work*—
  Where the work was carried on as a necessary prelude to the performance of the specific job solely, and no benefit to the future has derived to an extent that conservative accounting practice would permit to be temporarily capitalised.

(d) *Spoiled Work*—

Where the spoilage arises out of manufacturing risks peculiar to the specific job and is abnormal in relation to the type of production generally carried on.

(*Note*—In a job costing system the cost of spoiled work would have been included in the cost of the job by the ordinary routine of allocating material and labour costs. If the cost of spoiled work is not to be treated as a direct charge to the job, such cost must be credited to the job and debited to "overhead expense").

(e) *Production Royalties*—

Where the royalties are on a per unit basis and payable on production and not on sales.

Indirect Materials, Labour and Expense are, conversely, those items of expenditure which cannot be reasonably clearly identified with a particular productive unit or department.

Classification of Costs.

From the foregoing, it becomes possible to decide upon certain accepted classifications of costs, which are valuable in distinguishing and identifying stages covered.

1. Direct Material, plus Direct Labour = *Prime Cost.*
2. Prime Cost, plus Manufacturing Expense = *Factory Cost.*
3. Factory Cost, Plus Selling and Administrative Expenses = *The Cost to Make and Sell.*
4. Cost to make and sell, plus Profit (or minus Loss) = *The Selling Price.*

These various terms are constantly met in any study of Cost Accounting.

In addition to the foregoing classifications of Cost, the term may be given other interpretations, as, for example:—

Actual Cost—calculated on a basis of actual expenditure incurred under actual conditions—Costs as they actually are.

Normal Cost—calculated on a basis of certain nominated conditions—These would probably be costs as they could reasonably be expected to be under such nominated or "normal" conditions.

Average Cost—an arithmetical average of a number of costs.

Differential Cost—the difference in cost between one volume of output and another.

Estimated Cost—a predetermined and anticipated cost based on previous experience and expected future conditions.

Standard Cost—A cost figure based on definite bases and measures or "standards" relating to each element of cost. The standards should be scientifically assessed.

Economic Cost—Cost of a service to society by industry in supplying a market. This would include interest on capital and profit to cover effort, risk and sacrifice.

Some of these terms will be met in succeeding pages.

Distribution of Elements of Cost.

1. Direct Materials and Direct Labour are charged wherever possible to particular types or classes of product, or in the case of certain industries, into departmental costs.

2. Indirect Labour, Indirect Materials, together with other types of factory expense, are usually chargeable to specific types of classes of product,

or to a specific department, or maybe apportioned on some equitable basis over a number of departments.

Unit Costs.

These are the bases for computing all costing data so as to facilitate comparisons. Fluctuations in expense and production volume probably render useless any comparison of totals. Unit costs, however, have a comparative value and can be related to (1) the product produced, (2) the selling unit, (3) the method of production.

The unit costs may be expressed in terms of per ton, cwt., lb., mile, yard, foot, dozen, gross, hundred, thousand, barrel or gallon, or can be per article, piece, group of articles contract, or whole output. In service departments controlling power, it could be the kilowatt hour.

(a) *Uses of Unit Costs.*

These can be stated as

1. To control production by comparison between batches or with standards.
2. To control production by noting effect of volume upon production costs.
3. To facilitate valuation of stocks on hand.
4. To determine sales policy—
   (a) by elimination of unprofitable lines;
   (b) by noting effect of volume upon distribution costs;
   (c) by fixing prices as far as competition will allow.

Virtually, therefore, many of the advantages and aims of Cost Accounting are obtained through the medium of unit costs.

Cost Accounting is applied to the determination of:—

1. Costs expressed in terms of units of product—saleable units; and/or
2. Costs expressed in terms of units of performance—control units.

(b) *Determining the Cost of Saleable Units.*

The saleable unit may be a product manufactured solely to the express order and specifications of the customer, each order differing from others. This type is called contract or job production. On the other hand, products may be to the specification of the management, constituting a regular or standard line of goods, the trading in which is the object of the business. This may be called speculative production, as it involves production without specific order. It usually requires the carrying of stocks to meet sales.

The cost of the saleable unit may be obtained by:—

1. Making *one* accumulation of the costs relating to the product (the accumulation may be in respect of the customer's order if production is upon that basis, or over a selected period of time or quantity of products if production is speculative), or
2. Assembling a number of unit costs, each representing a portion of final costs.

The method adopted in each particular instance depends upon the following factors:—

1. The nature of the manufacturing operations.
2. The ability to identify the product.
3. The requirements for cost control.
4. The opportunity to sell the product at various stages of processing.

(c) *Division of Costs for Other Purposes—Control Units.*

Control of costs may require that total costs be broken down in other ways, particularly the following:—

1. Classification according to functional responsibility.
2. Classification according to specified activities.

Particularly where budgets or standards are in operation, costs may be required for the purpose of exercising control in relation to functions. Where, for example, a factory foreman is given an amount of budgeted expense, it would be necessary to collate actual costs in such a way as to ensure a figure comparable with the budget. Similarly costs may be accumulated for the purpose of controlling an amount allowed for some activity, e.g., experimental work.

Classification of Manufacturing Industries.

Manufacturing enterprises can be classified in a number of ways. One such division is as follows:—

1. (a) Special Order—e.g., carrying out a contract, such as building a bridge.
   (b) Repetition—e.g., continuously manufacturing a specified quantity of machines, say 50.
   (c) Continuous—e.g., continuous production without quantities being specified or known until the end of the period—such as 35,000 sq. ft. timber in one week.

An alternative classification would be:—

2. (a) Industries where there is prior determination of output (these would include 1 (a) and 1 (b)).
   (b) Industries where there is no prior determination of output, (this would include 1 (c)).

Job Costing Methods are usually applied to Special Order and Repetitive Industries. Process Methods of Costing are usually applied to Continuous Manufacture. This division is not, however, absolute, as many industries use both methods.

THE JOB COSTING METHOD.

By this method, cost is ascertained for predetermined quantities. It is commonly used, because nearly every manufacturing organisation has occasion to require it at some time or other, even if only for repair work. The system is used not only by those engaged in special order trade (e.g., contractors, tailors, shipbuilders, machine shops, foundries, garages) but also by those engaged in repetitive operations (e.g., makers of machinery, furniture, boots and shoes). (See Figure No. 1).

Subdivisions of the Job Costing Method.

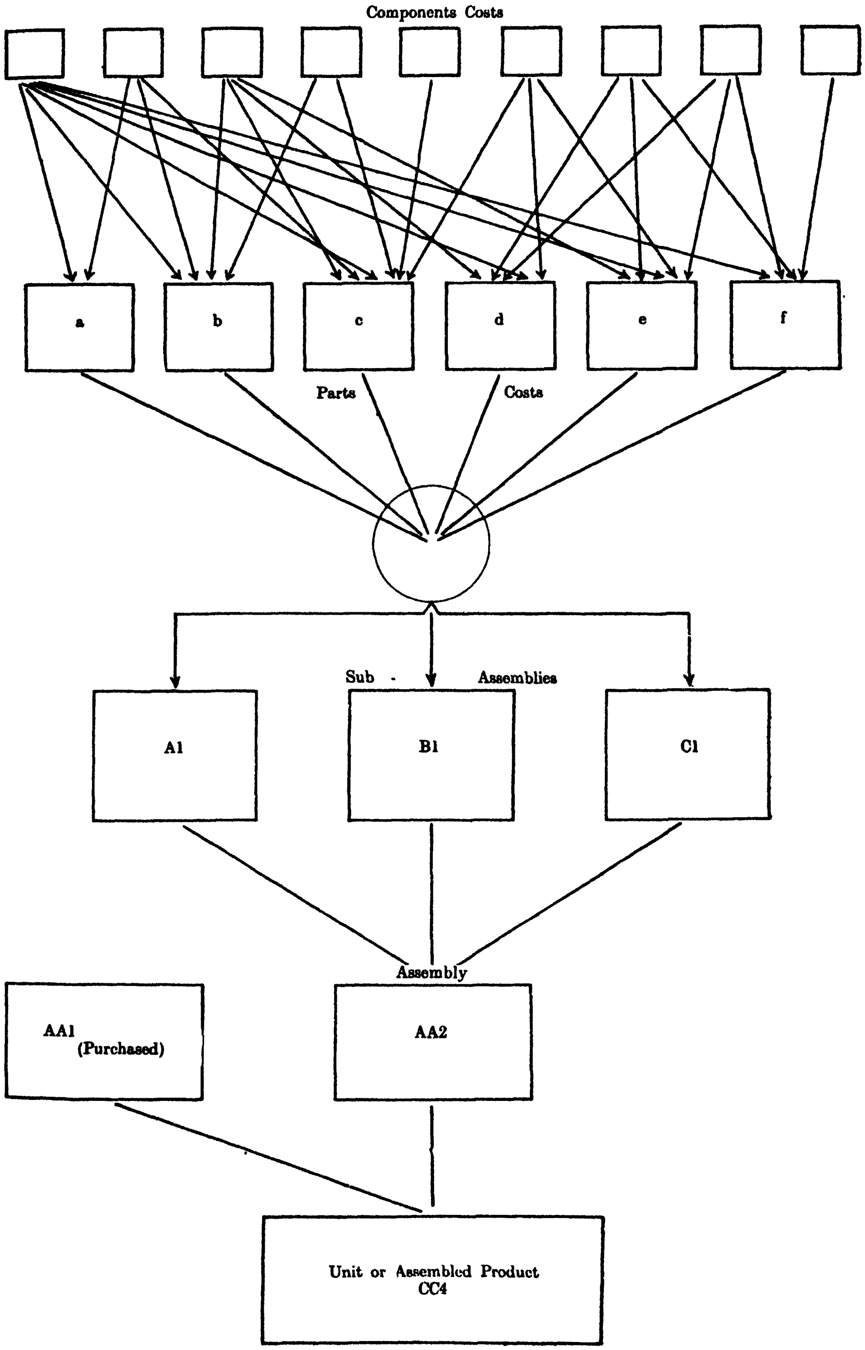
1. *Order, contract* or *terminal* costing refers to the finding of the cost of carrying out a contract, such as the erection of a building or bridge.

2. *Multiple* costing relates to the finding of costs in a business which manufactures a variety of goods which differ in value, kind, and the number or variety of processes necessary for completion. In this connection:—

(a) *Operation* costs cover the cost of each operation on each part rather than on each piece or quantity. With many engineering plants, it is often more convenient to cost certain parts or articles according to operations performed on them, particularly where such parts or articles are held in a partly finished state and are completed later.
(b) *Component* or *part* costs cover the cost of each component or part forming a unit.
(c) *Unit* costs cover the cost of each unit comprised of assembled parts.
(d) *Class* costs cover the cost of each group of assembled units.
(e) *Composite* costs cover the cost of a completed article made of various assembled groups. (See Figure No. 5.)

FIGURE No. 5.

FLOW OF COMPONENT COSTS TO FINAL ASSEMBLY.



The selection of the cost unit in multiple costs is of the utmost importance particularly where something less than the total cost of output is required. Multiple costs are often the most difficult of costing methods.

Manufacturing processes can range from the very simple to the extremely complex as, for example:—

1. One product of one operation, one size and one grade.
2. One product of two or more operations of one size and one grade.
3. One product of two or more operations of two or more sizes and one grade.
4. One product of two or more operations of two or more sizes and two or more grades.
5. Two or more products of two or more operations of two or more sizes and two or more grades, and so on.
6. Various products comprising various parts and sub-assemblies with varying sizes and grades.

The usual procedure for costing a product under the Job Costing Method is:—

1. *Issue production order or orders* for the product to be manufactured.
2. *Draw up cost sheets* to correspond with production orders.
3. As each order is proceeded with, *compile the cost* on the appropriate cost sheet.
4. After the order is completed *compute the unit cost.*

Production Orders.

A Production Order is a written authority for some responsible person to produce a specified commodity. It states:—

1. What is to be made.
2. Who is to do it.
3. When it is to be done.

Generally, it is issued by the planning or production control department

FIGURE No. 6.

PRODUCTION ORDER.

Production Order No.

Ordered by.................................... Date ....

Charge to.................................... Issued by..........................

Commencing Date.......................... Authorised by.....................

Finishing Date.............................

Quantity	Description	Drawing No.	Pattern No.	Tools Symbol Nos.	Scheduled

Specification Nos. Route Sheet No. Date Started

Date Finished

Bill of Material No. Cost Sheet {No. Entered Quantity Produced

FIGURE No. 7.

JOB PRODUCTION ORDER AND COST SHEET.

Production Order. No.

Product .... Quantity.............. ....
Style.. Date Commenced....................
Pattern .... Date Required....................
Departments .... Date Completed....................

Description
Specifications Authorised by

Materials

Date	Requ. No.	Dept.	Description	Quantity	Unit Cost	Total Cost

Wages

Date	Wages Summary No.	Dept.	Description	Hours	Total Cost

Applied Factory Expense

Date	Expense Sheet No.	Dept.	Description	Hours	Rate	Cost

Summary Prepared by
Total Materials £ Checked by
Total Labour £
Total Expense £ Passed by

Total £

and by it the various departments are notified what quantities of the commodity should be produced in order that the supply of finished goods will not be out of line with sales. (See Figures Nos. 6 and 7.)

The exact procedure governing the issue of a production order depends upon the type of product, for example:—

1. Where parts are purchased outside the organisation and assembled inside, a single production order would be issued for each lot of product to be assembled.
2. Where parts are made and assembled as required for customers' requirements, production orders would be issued for:—
   (a) The production of parts.
   (b) The assembly of parts when produced.
   The parts orders and the assembly orders may be issued at the same time.
3. In some organisations parts are made and then stored, to be assembled later when customers' orders are received. In such cases, production orders would be issued for parts in such quantities and at such intervals as to keep the necessary supply of parts on hand. Further production on assembled orders would then be issued as finished products are required to complete sales.

Cost Sheets.

It is quite common practice for a cost sheet to be drawn up for each production order at the time the latter is issued. (See Figure No. 8).

FIGURE No. 8.

JOB COST SHEET.

Job Cost Sheet. No...............

Production Order No. ....
Article ....
Quantity ....
Description ....
....
Authorized by..............................

Ordered by....................... ...
Promised for.......... ....
Delivery to..........................
Date Commenced.................
Date Completed....................

Materials		Wages		Expense			Credits
Stores Summary No.	Materials Cost	Wages Summary No.	Wages Cost	Dept. No.	Expense Summary	Expense Cost	Credits and Allowances

Summary
Materials £
Wages £
Expense £
Less Credits £
Cost £

Prepared by
Checked by
Passed by
Entered by Folio

In the case of a simple assembly product, space would be provided for:—

1. Particulars of production, order no., the costs required, for whom or for what the articles are being made, the date commenced. the date promised, and date completed.
2. A column for compiling charges for direct materials as used covering date, requisition no., quantity and cost.
3. Column for compiling direct labour costs as incurred, showing both date and total labour chargeable against the cost of the job.
4. A summary setting forth the amount of direct materials, direct labour, factory expense. the number of units produced and the unit cost.

Manufacture of Parts for Immediate Assembly.

Instead of the organisation purchasing all parts outside and then assembling, part "a" only may be purchased outside and stored until needed, parts "b" and "c" being manufactured in departments "B" and "C" respectively. The procedure would be:—

1. Department "B" would be instructed by production order to produce, say 40 units of "b," and department "C" 40 units of "c."
2. A parts cost sheet would be set up for each departmental order.
3. Parts "b" and "c" would be costed as separate products. The cost sheet for each would be charged for its own materials, labour and factory expense. The factory expense rate for part "b" would be based upon the factory expense chargeable to department "B," and that for part "c" upon the rate chargeable to department "C."
4. The parts when completed would be delivered to the assembly departments, which would then be instructed to assemble so many units of the completed product. An assembly cost sheet would be drawn up to compile the cost of the assembly.
5. The assembly cost sheet would be like an ordinary cost sheet except that provision would be made for the insertion of costs of parts "b" and "c", which would be taken from the cost sheets governing these items. The cost of part "a" would be taken from raw materials stores, as shown by requisitions. Labour cost would be obtained from time cards of the assembly department, and factory expense would be based upon the departmental rate. (See Figure No. 9).
6. When the cost sheet is completed the appropriate account in the finished goods ledger would be charged.

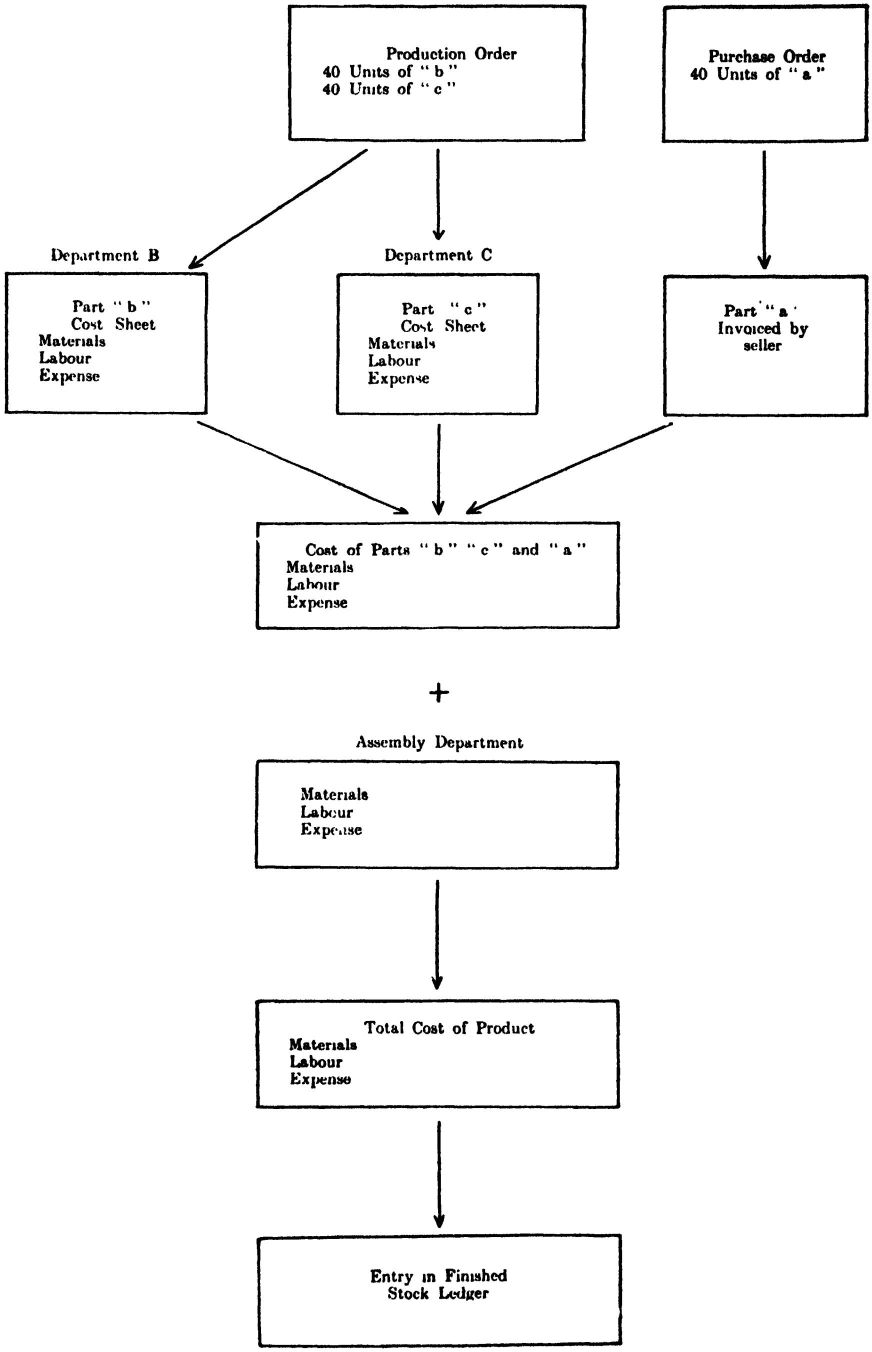
Parts Manufactured and Stored for Later Assembly.

In this case the organisation may still buy part "a" outside and may manufacture parts "b" and "c" but would store all parts until required for production.

1. A component parts ledger would be opened and would contain an account for each part manufactured and stored. As quantities of parts "b" and "c" were finished the cost sheets would be completed and the appropriate component parts charged.

FIGURE No. 9.

ASSEMBLY OF PARTS COSTS.



2. When the quantity of the major product was to be assembled an assembly production order would be issued and an assembly cost sheet prepared.
3. This would be charged with—
   - (a) Cost of part "a" taken from raw materials stores.
   - (b) Cost of parts "b" and "c" taken from component parts stores.
   - (c) Labour shown by assembly department time cards.
   - (d) Factory expense calculated, for example, by assembly departmental rate.

Factory Expense.

This, as will be seen later, is applied to cost sheets according to some acceptable basis, which may vary considerably between organisations. Generally a predetermined and composite rate is fixed upon because it is impractical to charge various jobs for specific items of factory expense. In practice, factory expense monthly rates may be calculated at the beginning of the month on the basis of estimated factory expenses. As lots of production are completed during the month the estimated rates would be applied to the cost sheets.

It would then be necessary to keep a record of factory expense actually incurred by the factory. It must be known with certainty whether the actual factory expense is different from the predetermined rate. It should be noted therefore, that there can be two phases of accounting for factory expense.

1. Applying estimated factory expense to jobs as they are completed during the month.
2. Compiling actual factory expense incurred during the month.

Standing Orders.

Authority for incurring actual factory expense is covered by standing orders. These are similar to production orders in that the latter represent authority to produce goods, whilst standing orders permit factory expense, such as repairs to machinery. Charges incurred on standing orders are compiled in accounts bearing the numbers of same, e.g., Repairs to Machinery may be charged to Standing Order No. 105. (See Figure No. 10). It should be noted that:—

1. A given set of standing order nos. is generally sufficient as long as production is carried on as most items of factory expense are incurred continuously.
2. To compile factory expense a factory expense ledger is opened. This would contain an account for each standing order, e.g. S.O.103 indirect material, S.O.104 indirect labour, S.O.105 repairs to machinery, S.O.106, 107, 108, etc., other factory expenses.

Plant or Betterment Orders.

These are instructions to, and authority for, constructing new plant or additions to existing plant. This would imply constructing buildings, equipment, etc., for the organisation itself and not for sale, i.e., where an

FIGURE No. 10.

STANDING ORDERS AND SUMMARY SHEET.

Dept. No. 10. Name Period From To

Code No.				1011	1012	1013	1014	1015	1016	1017	1018	1019.	1020	1021	1022		
Material Summary No.	Payroll Summary No.	Voucher Journal Fo.	General Journal Fo.	Supervision	Inspection	Repairs and Maintenance	Depreciation	General Labour	Fire Insurance	Workers' Compensation	Idle Time	Shop Supplies	Heating	Lighting	Spoiled Work	Summary of Standing Orders	Amount
																1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 Total Applied to Production Under Applied Over Applied	
				£	£	£	£	£	£	£	£	£	£	£	£		

organisation does its own construction work. (See Figure No. 11). In this case a betterment cost sheet would be drawn for each betterment order and it would be charged with:—

FIGURE No. 11.

PLANT OR BETTERMENT ORDER.

Plant Order No......

Date Issued........... .... Pattern No............................
Required by.............................. Drawing No............................

Please make and deliver to

(Full description of Plant to be made)

To be marked.............................. Authorized by:.....................
Inspection by.............................. Received by..........................
Date Required........................... Entered in Plant Ledger............
Date Commenced........................
Date Finished..............................

(a) All materials used on the job.

(b) All labour used.

(c) An appropriate amount of factory expense.

When completed, an asset account, such as building, plant, machinery, etc., would be debited with the total cost. It will be noted that the procedure in this regard is similar to that controlling an ordinary production order.

The Ledgers Used.

1. *Materials Ledger.*—This would contain a card or account for each type of material used in production. As each type of goods is received, the card for that type is debited. As material is used this card is credited from the materials requisition. Each card therefore indicates the amount of the particular type of material on hand at a given time and the sum of the balances shown by the cards represents total stock.
2. *Job Ledger.*—This contains a cost sheet for each lot or job in process of manufacture. As a new job is commenced a new cost sheet is placed in the ledger and as one is finished the appropriate cost sheet is completed and removed from the ledger. The total of all charges in this ledger at any given time therefore represents the value of work in process. The job ledger can, if desired, be divided according to departments.
3. *Component Parts Ledger.*—This contains an account for each part manufactured and stored. The accounts are debited with parts produced and credited with parts used or sold. The total of all balances at any given time represents the cost of parts on hand.

4. *Finished Goods Ledger.*—This is debited with all finished goods received and credited with those sold. The balances in the ledger represent cost of finished goods on hand.
5. *Factory Expense Ledger.*—This contains an account for each factory expense, and the total charges to these accounts during a month equal the total factory expense for that month.

These various ledgers are covered by control accounts with which they should balance. Control accounts, however, do not only provide an automatic check over the entries in the corresponding ledger. In addition they summarise and present in tabloid form, information of managerial type and furthermore facilitate its preparation by giving an overall picture with speed and ease. As the controlling account gives the information in total, the subsidiary ledgers can be in a variety of forms, such as loose ledger sheets, cards, analysis sheets, cost sheets, production orders, etc.

The principle of control accounts is, of course, to be found in financial accounting. A Sundry Debtors' Control A/c. usually covers the individual sundry debtors' accounts. The same principle is observed in the operation of control accounts in cost accounting procedure, as, for example, in the following:—

Materials Control A/c.

This is used to cover the various subsidiary accounts in relation to the receipt and issue of materials. Frequently several accounts are used to cover various sections of materials control. For example:—

Raw Materials Control A/c.—covers all raw materials in Store, the individual records appearing in the Raw Materials Ledger. Debits and credits posted individually to these ledger accounts are posted in total to the Raw Materials Control A/c., the balance of which should equal the balances in the individual accounts included in the Raw Materials Ledger.

Component Parts Control A/c.—covers all parts appearing in the Component Parts Ledger A/c.

Finished Parts Control A/c.—covers all items of finished stock in the Finished Parts Ledger A/c.

Work in Process Control A/c.—covers all charges appearing, for example, in the various Cost Sheets and comprising materials issued into production, labour carried out on production and expense appropriated to production. Sometimes separate control accounts are instituted in relation to each element in Work in Process, as, for example:—

Work in Process—Materials.

Work in Process—Labour.

Work in Process—Expense.

Factory Expense Control A/c.—covers the various items of Factory Expense entered on the Standing Orders.

Applied Factory Expense Control A/c.—covers the total of the individual amounts of factory expense applied to the various production orders.

The operations in these ledgers and control accounts are explained in more detail in later chapters.

PROCESS COSTS.

This is an essentially different type of costing from the Job Order Method. It is found in those industries where the factory has a continuous stream of production, rather than successive separate jobs. The manufacture of flour or cement or the operations of a timber mill would be examples of process costing. In all of these cases, quantities of raw material are started in process at intervals and become intermingled, so that separate lots cannot be identified. It is obviously impossible to charge each portion of the productive stream with its own elements of cost. The process method therefore provides an *average* cost of production by *periods*. The total cost of labour, material and factory expense is divided by units produced to obtain the average unit costs. (See Figure No. 2).

In process manufacture the product usually flows through the producing departments in a certain sequence and according to a set routine. Each department performs a particular step, and when the product has passed through the last operation it is ready for sale. Cost finding therefore involves tracing the product from the raw materials stage through the various producing departments, finally arriving at the finished goods stage. Each producing department or manufacturing development adds its cost to the preceding stages. In order to accumulate costs at various stages there would be three general types of charges:—

1. Conversion charges which comprise the costs of labour, supplies and factory expense applied at each stage.
2. Transfer charges which record the cost of goods passed from one stage to the next, e.g., the debit to Department No. 2 for process material received from Department No. 1.
3. Separate accounts for each service department in the organisation (at the end of each month the service department balances are closed and transferred to the producing department in the proportion from which they have benefited from services). The conversion costs mentioned in (1) therefore must include a share of service department costs.

Functions of Process Costing.

Where the product passes through successive departments the functions of process costing are:—

1. To determine the cost of operating each service department month by month.
2. To determine the unit conversion cost for each producing department, i.e., the conversion cost for the month divided by units of output for the month.
3. To determine the unit cost of completed goods transferred to finished goods account.

The routine of costing can be divided into—

(1) *Current records.*—(During the month).

(a) Compile the cost and weight (or other measure) of materials purchased.

- (b) Compile—
  - (i) Weight of material used.
  - (ii) Weight of partly finished materials transferred from one department to the next in succession.
  - (iii) Weight of product completed and transferred to finished product stores.
  - (iv) Weight of product sold.
- (c) Compile cost of labour, supplies and expenses by departments.

(2) *Monthly closing.*—(At the end of the month).

- (a) Total the service costs for the month and distribute to using departments.
- (b) Total the producing department costs and determine the unit conversion cost for each department.
- (c) Prepare transfer entries for—
  - (i) Raw materials used.
  - (ii) Partly finished goods transferred to next department.
  - (iii) Product completed.

Process Costs Sheets.

To facilitate the monthly closing of process accounts a process cost sheet may be used. In such cases the entries for current operating charges are spread on the sheet instead of being posted directly to the accounts. The cost sheet then serves as the basis for preparing (1) closing entries, and (2) operating statements without the necessity for referring to the ledger accounts. (See Figure No. 12).

The Process Cost Sheet is the underlying report prepared under the process method of costing. It is an abstract of all operations for the month. Conversion costs should be kept separate from transfer charges. Obviously, the conversion cost of a given department is the real measure of its efficiency. It is the cost for which the head of the department is responsible. It indicates what happened within the given department and is not distorted by changing costs in previous stages of manufacture.

An examination of the actual method of cost accounting treatment both under Job Order and Process system will be found in later chapters.

BOOKS OF ORIGINAL ENTRY.

Cost Accounting is more concerned with internal transactions than in the case of Financial Accounting. Its primary records, therefore, are usually of different type from those associated with the latter. In the case of materials, for example, the receiving notes and the stores requisitions can be used for the necessary entries in the Raw Materials Ledger and summaries of such would be used to make the necessary entries in the appropriate Control A/c.

Similarly in the case of wages, the various time cards may be used as posting mediums although, more frequently, some summary of these would be prepared. A complete summary covering the total wages paid during a period would be used to make the necessary entries in the Wages Control A/c.

FIGURE No. 12.

PROCESS COST SHEET.

Charge to Commencing Date Finishing Date							No.					Date Issued by Authorised by
Materials Requ. Summary	Payroll Summary	Expense Summary	Department No. 1			Department No 2			Department No. 3			
			Materials	Labour	Expense	Materials	Labour	Expense	Materials	Labour	Expense	
												Department No. 1 £ Materials £ Labour Expense Department No. 2 £ Materials £ Labour Expense Department No. 3 £ Materials £ Labour Expense £ Production No. of Units Cost per Unit

In addition to the foregoing, however, certain books of prime entry are directly associated with costing entries. Of these the most important are:—

Purchase Journal.—This is frequently used for its primary purpose under Financial Accounting extended to take into account the necessities of Cost Accounting. A columnar arrangement is sometimes used to facilitate recording of various sections of materials as, for example, raw materials, purchased parts, finished stock, etc. Control Accounts for each of these would derive their entries from the total of each columnar dissection.

Voucher Register.—As its name implies, this journal involves the use of number vouchers which are the authority for the entry made. The use of vouchers facilitates the handling and recording of transactions and the payment of obligations arising therefrom, and, in addition, ensures the necessary approval for all vouchers entered in the register. Usually, the voucher and its entry in the Register are tied with the payment by a cheque register or by a cross reference in the cash book. Vouchers can be drawn up in a variety of ways, depending upon the type of organisation and the particular functions that the voucher is designed to cover. Usually a voucher would be supported by the various appropriated documents. In the case of payment for materials purchased, the voucher may be supported by:—

(a) A purchase requisition.
(b) A purchase order.
(c) A receiving report.
(d) An inspection report.

Cost Journal.—A journal of this type is sometimes used for transfer entries and also for items of factory expense which do not involve a payment, e.g., depreciation. Standing Journal Entries can also be entered in the Cost Journal. These are journal entries which are repeated at regular intervals, such as monthly, though the amounts may, of course, differ. At times the journal entry is outlined and monthly amounts are entered in columnar fashion, twelve columns being provided to take the full year's figures. Similarly clearing Expense Accounts can be entered in the Cost Journal. These provide for the re-distribution of service department expenses to the various productive departments.

General Journal.—In some cases certain of the entries outlined above as appearing in the Cost Journal may be entered in the General Journal. mostly in cases where no Cost Journal is kept.

CHAPTER 3.

MATERIALS—PURCHASING.

Purchasing in relation to Manufacturing has been defined as "the procuring of materials, supplies, machines, tools and services required for the equipment, maintenance and operation of the business." (Alford, "Cost and Production Handbook," p. 343.)

Classification of Purchases.

1. Raw materials may be defined as basic unfabricated materials, and are generally purchased in large quantities, e.g., pig iron, copper, lead. timber, cotton, etc. The precise meaning of raw materials, however, depends upon the particular organisation, as the finished goods of one factory may be the raw materials of another.

2. Supplies are the many items necessary for the operation of the plant, office, etc. In general, they do not enter into the product, but are necessary in operation. They include nuts, washers, screws, packing, lubricants, stationery, etc.

Functions of the Purchasing Department.

The principal functions of the purchasing department are:—

1. Obtaining and recording information as to prices and sources of materials for manufacture or other use of the plant, and for resale.
2. Obtaining and recording all relevant factors governing the supply and cost of materials needed in production.
3. Standardizing through specifications of the quality, size, etc., of materials needed. This avoids the ordering of different makes or grades of the same material by different departments, and makes quantity purchases possible.
4. Making purchases of materials, equipment, and supplies as authorized by properly approved requisitions.
5. Preparing and issuing purchase orders to vendors, also issuing supplementary orders, if necessary, to cancel or modify original orders.
6. Securing delivery of materials when promised by maintaining a systematic follow-up of purchases and by keeping a record of all unfilled orders under contracts.
7. Verifying invoices to see if they agree with purchase orders and with reports of materials received as to quantity, and if the prices, terms, extensions, and additions are correct.

The foregoing functions are, in practice, assigned to the purchasing department. Other functions which may be handled by the purchasing department in small organizations are:—

8. Receiving goods and verifying the quantities received by actual count or measurement and reporting thereon.

9. Inspecting the goods; that is, examining and testing materials received to determine whether they correspond with the specifications in the purchase order as to quality.
10. Storing — covering the receiving of the materials into storerooms, care of, and accounting for, materials on hand, and delivery of materials to the factory on material requisitions.
11. Traffic—having to do with the classification of shipments, determination and verification of freight rates, expediting transportation and adjusting claims with transportation companies.

In a large organization, separate departments, of course, exist for receiving, inspecting, storing, and traffic management.

Purchasing Procedure.

The usual steps in the ordering of goods would include provision for:—

1. A Purchase Requisition directed to the Purchasing Department from the department requiring the goods.
2. A Request for Quotations after inspection of the records of the Purchasing Department and determination of where the goods are likely to be economically and satisfactorily supplied.
3. A Purchase Order sent to the successful tenderer or proposed supplier of the goods.
4. A Follow-Up Service to ensure that the goods ordered are supplied on time.
5. Receiving and Inspection Reports covering the actual receival and inspection of the goods.
6. Return Slip to record the return of any goods not up to standard or requiring adjustment.

Purchase Requisition.

A Purchase Requisition is a request on the Purchasing Department to purchase a definite quantity and kind of material for either specific or general use. The request may emanate from a number of sources. (See Figure No. 13.) Among them are:—

1. The Stores Department, to replenish an article or store either out of stock or which has been reduced to an agreed upon ordering point.
2. The Production Department, which requires material immediately and which may be accepted direct by them.
3. The Engineering Department, for material required and not available from stock, required for a special purpose such as experimental work.
4. The General Management, for the purchase of such things as machinery and equipment or perhaps special purpose tools.
5. The Secretary or Accountant for printing or stationery items or office equipment.

The Purchase Requisition is generally made out in duplicate. The original is sent to the Purchasing Department, while the issuing source retains the duplicate. The Purchase Requisition very often contains:—

1. Date.

FIGURE No. 13.

PURCHASE REQUISITION.

Date

Please Purchase for

Department No.

Deliver to

No.

Purchase Order No.

and Production Order No.

at

by

Quantity	Item No.	Code No.	Description	Quality	Remarks

Requested by

Checked by

Authorised by

2. Purchase Requisition number.
3. Department making the request.
4. Description of goods required, including the quantity.
5 Reason for the requirement (e.g., out of stock).
6. Location for delivery.
7. Date when goods will be required.
8. Account to which goods are to be charged.
9. Authority for purchase, e.g., signature on requisition, approval by Stores Superintendent, etc.

Where the Purchasing Department deals with the requisition, it will insert the name of the supplier, together with terms and conditions relating to the purchase.

It is of vital importance that material requisitions be approved by some competent authority. It may be that the engineering department collaborating with the production division is preparing to discontinue the manufacture of certain articles, and to manufacture instead newer models which will involve a complete change of specifications. Such plans, involving as they do changes in styles, policy, etc., are known ordinarily to only a limited number of persons in a plant; consequently all Purchase Requisitions should always be approved by some one of this limited circle of persons in order to prevent overstocking of materials, which may rapidly become obsolete.

The signature of the stock record clerk ensures the accuracy of the stock balance shown on the requisition. If the quantity shown to be on hand by the storekeeper at the time he makes out the requisition, does not agree with the stock balance shown by the records kept by the stock record clerk, an attempt should first be made to locate the source of error. If the records still disagree, the only solution is to take a physical inventory and, using that as the correct figure, adjust the stock record to agree with the physical inventory.

In order to help the storeman and the purchasing agent, maximum and minimum quantities are frequently arranged in connection with stocks. Maximum quantities are usually fixed taking into account:—

1. Rate of consumption, economic quantity and possible price fluctuations.
2. Storage facilities and physical nature of commodity.
3. Financial and sales budget requirements.

Minimum quantities take into account:—

1. Time cycle from date of purchase order to receipt of material in store, allowing for safety margin.
2. Source of supply and stability of supplier.
3. Rate of consumption.
4. Ordering risks involved.

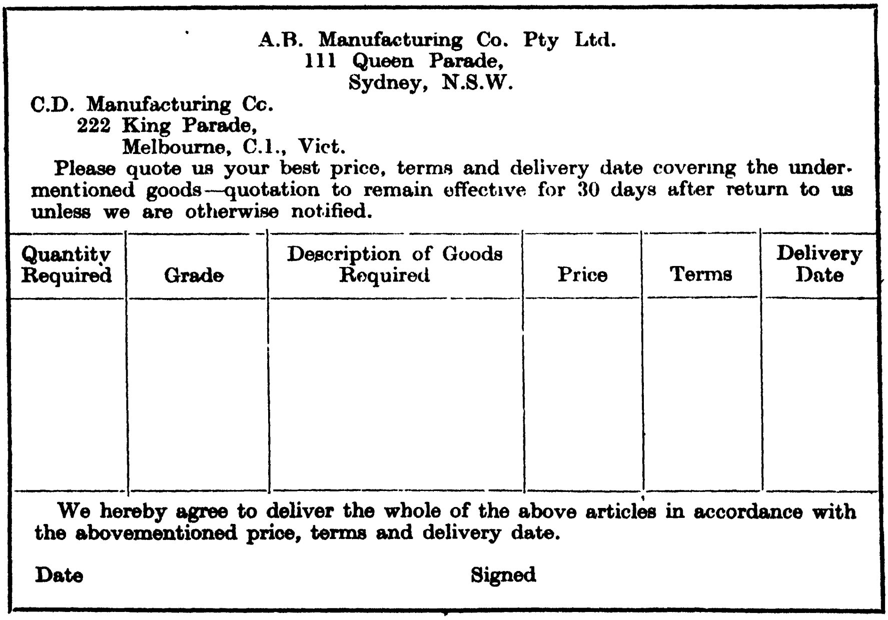
Finally, it should be noted in connection with the requisition, that the order number space is filled in only after the storekeeper is notified of the purchase order number, issued against the requisition.

Request for Quotation.

Upon receipt of the purchase requisition, the purchasing agent consults his files for the best supplier. If he is not certain of the correct price to pay, or if he is not sure which is the best supplier, he should issue a Request for Quotation on a number of suppliers. (See Figure No. 14.)

FIGURE No. 14

REQUEST FOR QUOTATION.



A.B. Manufacturing Co. Pty Ltd.
111 Queen Parade,
Sydney, N.S.W.

C.D. Manufacturing Co.
222 King Parade,
Melbourne, C.1., Vict.

Please quote us your best price, terms and delivery date covering the undermentioned goods—quotation to remain effective for 30 days after return to us unless we are otherwise notified.

Quantity Required	Grade	Description of Goods Required	Price	Terms	Delivery Date

We hereby agree to deliver the whole of the above articles in accordance with the abovementioned price, terms and delivery date.

Date Signed

(The form is in duplicate, the original to be returned to A.B. Manufacturing Co. Pty Ltd., duplicate retained by C.D. Manufacturing Co.)

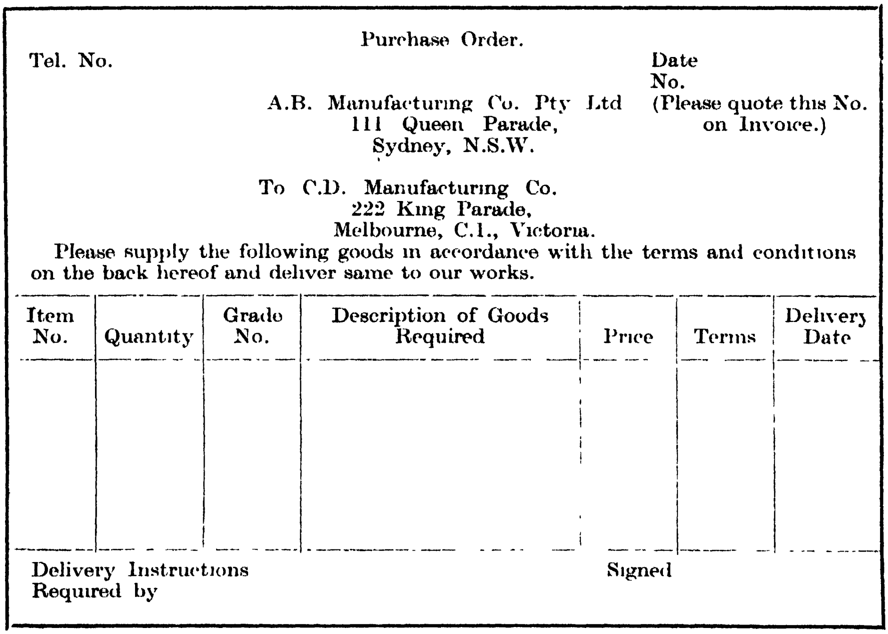
This form should state the quantity and description of the goods required together with time for delivery and the location for such. In addition to asking for the price and terms of payment it should indicate that any special conditions required by the vendor should be clearly stated.

Purchase Order.

Once having decided who the vendor is to be, a Purchase Order is made out. This is a form on which are entered definite instructions to the vendor to supply a certain quantity of material according to price, terms and specifications noted thereon, and is the vendor's authority for the sale. (See Figure No. 15.)

FIGURE No. 15.

PURCHASE ORDER.



Purchase Order.

Tel. No.

Date
No.
(Please quote this No. on Invoice.)

A.B. Manufacturing Co. Pty Ltd
111 Queen Parade,
Sydney, N.S.W.

To C.D. Manufacturing Co.
222 King Parade,
Melbourne, C.1., Victoria.

Please supply the following goods in accordance with the terms and conditions on the back hereof and deliver same to our works.

Item No.	Quantity	Grade No.	Description of Goods Required	Price	Terms	Delivery Date

Delivery Instructions
Required by

Signed

The purchase order generally contains the following information; Date, purchase order number, vendor's name, address, quantity, description of material needed, price, terms, signature of purchasing agent. It also contains directions as to shipment, marking parcels, etc. Since the issuing of a purchase order signifies a legal obligation, the vendor's copy usually has a number of clauses or conditions printed either on its face or the reverse side, subject to which the vendor accepts the order.

The number of copies made of the Purchase Order depends entirely upon the particular system in each organisation. For example, six copies may be made:—

1. Vendor's copy, sent to the seller.
2. Record copy for filing under vendor's name.
3. Record copy for use in a tickler file to ensure delivery follow up.

4. Receiving copy, sent to Receiving Department.
5. Receiving ticket, sent to Receiving Department.
6. Copy for Accounting Department.

As soon as the purchase order is issued, the stock record clerk is notified. He then makes an entry in the ordered section of his stock record. In addition, the stores clerk makes a notation on his file copy of the requisition of the order number and promised date of delivery.

Follow-up of Purchase Order.

This is important, as maintenance of uninterrupted production schedules depends upon goods being received in time. Every order should bear a date for latest delivery, and it is the duty of the person in charge of the follow-up service to see that this is kept. He should:—

1. Secure an acknowledgment or acceptance of the order, wherever necessary.
2. Secure a promise of delivery consistent with requirements.
3. See that the delivery promise is kept.
4. If such promise is not kept, see that any necessary emergency action is taken.

Receiving.

The duties of the Receiving Department include:—

1. Recording receipt of the goods.
2. Taking necessary action to ensure inspection.
3. Seeing that delivery of material is made to the correct destination.
4. Notifying the purchase agent of any adjustments.

Upon receipt of the material the receiving clerk makes out a Receiving Report in triplicate, one copy remaining as the receiving record, another going to the purchasing department for comparison with the order, and the third to the accounting department as a voucher for the relative invoice. (See Figure No. 16.) He then checks the material, sometimes

FIGURE No. 16.
MATERIALS RECEIVED NOTE.

Materials Received Note. No.

Received from ....

.... Purchase Order No.

....

Quantity or Weight	Item No.	Grade	Description	Remarks

Date put into Stock
Date sent to Office
Entered in Stock Ledger

Received by

Checked by

stores it, notes the quantity received on the bin card and forwards a copy to the stock record clerk. The latter then records the quantity received and forwards the copy to the purchasing department. In some organisations, receiving records are made on copies of the purchasing order, the latter being ruled in such a way as to facilitate this, thus saving time and stationery.

Where goods are not up to standard the procedure usually followed in returning the goods is to complete a Returned to Vendor form, copies of which are sent to the Vendor, to the Purchasing Agent and to the Accounting Section. (See Figure No. 17.)

FIGURE No. 17.

RETURNÉD TO VENDOR FORM.

Materials Returned to Vendor.

No.................. Date..................

The following materials have today been returned to
E.F. Manufacturing Co. Pty Ltd.,
1 Lincoln Ave.,
Sydney.

Quantity or Weight	Description of Material	Unit Cost	Value

Reason for Return

Storeman
Return Authorized by

Vendor's Invoice.

Usually the vendor's invoice is sent to the purchasing department and if received before the material arrives is placed on file to await the consignment.

When the material is received and the purchasing department obtains the original receiving report, it has a complete history of the transaction, namely the purchase requisition, showing the authorisation of the purchase order; the purchase order, showing the quantity ordered, the price to be paid and terms; the receiving report, showing the quantities received and inspected.

The original invoice is then checked against the duplicate purchase order and original receiving report and stamped. The stamp includes the following information:—

1. Whether the quality, terms and extensions are correct.
2. Account to be charged.
3. Receiving Report and Purchase Order numbers.
4. Space provided for approval by the purchasing agent.

The original invoice with the original receiving report attached is then sent to the accounting department for entry in the voucher register, and then may be turned over to the cost department for entry of price on the stores ledger.

Where a duplicate invoice is obtained, the duplicate, together with the original purchase requisition and the duplicate purchase order, are attached together and filed by the purchasing department for future reference.

Invoices should be checked and approved with a minimum of delay in order to facilitate prompt records. Where invoices require correction, this should also be attended to speedily. Errors may occur in kind of material, quality, quantity, price or date of delivery.

Purchasing Efficiency.

Every purchasing agent should keep the following factors constantly in mind in determining his purchase:—

1. He must be sure that the article selected is suitable for the use to which it is to be put.
2. He must satisfy himself that its quality meets the specifications of the requisition.
3. He must be sure the quality is uniform throughout the shipment.
4. He must purchase it at the best price consistent with the requirements and on the most advantageous terms.
5. He must be confident that he can obtain delivery within a safe time of when the purchase will be required.
6. He must determine the proper quantity to meet the current needs, with due regard to the seasonal demand and supply.
7. He must obtain a guarantee of stated prices for a fixed period wherever desirable, and, if necessary, protection against a decline of prices during a period covered by an agreement.

When the purchasing department functions, its work develops through seven distinct stages:—

1. Determination of the articles required.
2. Learning what the market offers.
3. Selecting the vendor.
4. Determining the price.
5. Making the contract.
6. Effecting the delivery.
7. Completing the contract.

Relation of Purchasing to Cost Accounting.

The foregoing methods of purchasing meet the requirements of accurate cost accounting, the following being the essentials from a cost accounting standpoint:—

1. The authority to initiate requests for purchase of materials should be definitely fixed. Such requests should be written on a prescribed form of purchase requisition, which should pass to the purchasing department for review and approval.

2. The orders to be placed with vendors should be issued only on a prescribed purchase order form.
3. The procedure of the purchasing department should ensure complete verification of each purchase invoice, through a comparison with the corresponding purchase order, and checking with an independent report of material actually received.
4. Each purchase invoice, as forwarded to the accounting department, should bear on its face evidence that all authorisations, verifications and approvals have been attended to and accounted for, and should indicate the symbol of the account to be charged.

CHAPTER 4.

MATERIALS—STORES CONTROL.

Functions of a Stores Department.

These will vary in different organisations, but in general a stores department should :—

1. Act as a repository for goods purchased and/or manufactured, and show the exact location of goods readily.
2. Make necessary provision for the adequate protection of materials or goods held.
3. Arrange for the speedy issue of the necessary material properly required, and thus save time of production employees.
4. Ensure orderliness in functions and identification of materials.
5. Facilitate localisation, detection and prevention of waste, as well as losses by carelessness and pilfering.
6. Make possible adequate insurance cover and reduce possibility of theft and risk of fire.
7. Give information regarding stock turnover, locked up capital, maximum and minimum requirements, over or under stocking.
8. Facilitate efficiency and economy in management resulting from available figures, returns and data from which management can control policy.

The foregoing functions should be exercised in relation to the storage of and the accounting records relating to:—

(a) Goods prior to manufacture.
(b) Goods in process of manufacture.
(c) Goods completely manufactured.

In order to carry out such functions satisfactorily, it is essential that the stores systems should:—

1. Arrange for all transactions to be clearly defined, both in relation to receivals and issues.
2. Allow for adequate records facilitating comparisons between stock records and actual balances.
3. Undertake the segregation and identification of classes, sizes, grades, etc., of each product.

Importance of Stores Control.

It should be remembered that the investment in stocks is a most important item in nearly every balance sheet and, in some cases, is the largest single item. Care must, therefore, be exercised to keep stocks at the lowest possible figure consistent with serving the best interests of the business, and this naturally includes ensuring smooth running production. It is unwise to sacrifice security for economy in stores inventories, and the happy medium must be attempted.

Economics of Stores Control.

The following costs are often involved in excessive stocks:—

1. Interest on amount involved.
2. Depreciation in value or condition of stocks.
3. Cost of obsolescence.
4. Costs associated with extra space requirements.
5. Costs of additional equipment necessary.

Frequently it will be found that causes such as the following will have contributed to excessive stocks:—

1. Materials have been purchased for customers' orders subsequently cancelled before production, no effort being made to use the materials.
2. Materials received are in excess of quantities ordered and the balance was not returned.
3. Excess purchases made by an extra allowance being added on the occasion of each production or purchase order.
4. Materials may have been ordered in expectation of orders which did not eventuate.
5. ✓ Over estimates on the part of the production or sales departments.

The methods most frequently used to decrease stocks and increase stock turnover are:—

1. Careful planning and scheduling.
2. Preparation of materials budgets.
3. Periodical analysis of stocks.
4. Staff control and training.
5. Economical handling of materials.
6. Simplification and standardisation.
7. Return of excess stocks received from vendors.
8. Production only in accordance with customers' orders actually received.

In materials control there is a conflict amongst many of the important factors. Some of these are shown hereunder:—

1. Costs which tend to decrease as the size of the order is increased:—
   - (a) Purchase price.
   - (b) Cost of purchasing.
2. Costs which tend to increase as the size of the order is increased:—
   - (a) Cost of materials storage.
   - (b) Materials investment charges, including interest on investment, insurance, risks of obsolescence, and depreciation.

Layout and Storage Factors.

The following are the most important factors which must be considered in relation to layout and storage:—

1. The nature of the goods to be stored, including dimension, volume, quantity or physical or chemical properties of the various materials.

2. The number, sizes and specifications of stores available.
3. The convenience to and accessibility by manufacturing departments, considered specially in relation to (1) and (2).
4. Grading requirements of various materials, including classes and types.
5. Restrictions and regulations laid down by insurance or fire brigade authorities.

Generally, requirements arising out of the foregoing are:—

1. Diverse chemical and physical qualities in materials often demand separate storage facilities.
2. Differences in qualities and grades may necessitate separate storage. This is often provided by bins, racks, shelves, etc.
3. Bulk goods may require separate storage of particular type.

Very often totally different storage problems are encountered in relation to the three different types of industry, viz.:—

(a) Job order or contract.
(b) Repetitive.
(c) Continuous.

Location Factors.

Location of an item would be governed by such factors as:—

1. Difficulty of handling.
2. Quantity to be carried and the frequency of its use.
3. Physical and chemical properties.
4. Special considerations such as perishability, etc.
5. Safety considerations, such as insurance (covering fire hazards), floor strength, etc.
6. Accessibility to production section requiring the material.

Materials Handling.

The cost accountant should note that high handling costs are often indicated (and in any case it is usually wise to devote some attention to such factors) where:—

1. Unnecessary handling is performed.
2. More than one man is moving material without mechanical assistance.
3. Men are lifting and handling articles weighing over, say, 100 lbs.
4. Men are shifting from floor to trucks, or from trucks to floor.
5. Machine operators are doing any laborious work as distinct from putting articles into or taking articles from their machines.
6. Materials are moved from container to container.
7. Materials are unnecessarily diverted from a receiving platform for clerical records or inspection when they should go direct to machines or to departments.
8. Men on assembly floors are waiting for materials.

9. There are delays in delivering from stores locations to operators.
10. Scheduling for delivery is inadequate, necessitating extra delivery trips.
11. Antiquated apparatus or methods are in use.

Symbols and Classifications.

In industrial operation, and, indeed, in the compilation of costs, an orderly organised arrangement of facts is essential, and this condition is materially contributed to by such devices as symbols and classifications.

A symbol is a special indication, mark, character or group of characters consisting of figures, letters or signs, designed to represent an item or an idea.

A classification is a grouping of items having similar characteristics, each item often being represented by a symbol.

Their purpose is:—

1. To indicate a particular item definitely, that is, to the exclusion of all others;
2. To facilitate brevity in writing orders, reports, etc.

The following are the important principles of symbolisation:—

1. A symbol should be exclusive to such an extent that it should completely and unmistakably distinguish the items it represents from each and all others.
2. It should, if possible, automatically indicate by its form, the class and principal sub-classes in which the item represented by it belongs.
3. A component or designation of a symbol should include all that follows it, and limit all that precedes it.
4. A system of symbols should be simple, brief, definite, an aid to memory, and should have the property of elasticity.

The following are the main systems of symbolisation:—

1. Alphabetic, where the symbols used are letters or a combination of letters, e.g., A, AB.
2. Numeric, where indication is made by a number or a combination of numbers, e.g., .027, .0341.
3. Mnemonic, in which the symbol for each item suggests the name it represents. It may be a letter, a number of letters, or both letters and numbers for example, to designate size, e.g., P126 (Patterns), T247 (Tools).
4. Signs or signals, these being used to denote certain designated items, e.g., Door.
5. Mixed systems, in which each symbol is made up of both figures and letters, without necessarily being mnemonic, e.g., A4/231/TD.

In connection with the foregoing, the Dewey Decimal System has been developed strongly for some purposes, and is now often found in operation in all types of businesses, though most organisations still prefer to develop their own classification and symbols according to the peculiarities met.

Forms for Materials Recording and Accounting.

Matters connected with Purchasing and Receiving were dealt with in the previous chapter, but it is necessary to note that all receivals into stores need not come in by purchasing. Where materials which have to be manufactured are needed, a Production Order Requisition can take the place of a Purchase Requisition, and a Delivery to Stock form can be used to record items received into stores through production channels.

The following are the remainder of the forms necessary for the control of materials.:

1. *The Stores Requisition.*

Materials are issued from stores as required upon presentation of a Stores Requisition which, like a cheque drawn upon a bank, should, when signed by a responsible person, represent the authority for delivery of the amount of the stores outlined thereon. (See Figure No. 18.) The information on the requisition should include:—

(a) The requisition number account to which the value of the material is to be charged (either the name or the symbols). This would represent either a production order, standing order, plant order, or repair order.

(b) Quantity and description of material required and the unit.

(c) The department requiring the material and its location, or the production unit to which delivery is to be made.

(d) The delivery time required.

(e) The signature of the authorising officer and the date of approval.

(f) The signature of the person receiving the material.

FIGURE No. 18.

STORES REQUISITION.

Raw Materials Requisition.

Date.............................. No.

Charge to ....Dept. Job No.

.... Expense No.

Description of Material	Quantity or Weight	Grade	Price	Value

Supplied by Authorised by

Entered in Stock Ledger Folio Date

A usual routine procedure would be for the Stores Requisition to be in duplicate, both copies being sent to the storekeeper, who would issue the material and obtain a receipt for it. The receipt is generally on the duplicate copy, which is retained by the storekeeper, the original copy being sent to the stores ledger clerk, who computes the value of the materials and enters it in the stores ledger. He then includes it in the Summary of Material Consumed Form and forwards the requisition to the cost clerk, who enters it in the material cost section of the production order (or cost sheet), or of the standing plant or repair order. General internal conditions will indicate whether it is wise to confine materials for one production order to one requisition. Sometimes only one kind of material is entered on a requisition, but this may be extreme. When numerous articles are required from stores, the requisition sometimes takes the form of a Specification Schedule or a Bill of Material.

2. *Materials Returned Form.*

Returns from a department may consist of:—

(a) The whole of the requisitioned material, where none of it was requested or required.

(b) Portion of the requisitioned material where it was not all requested or required.

(c) Scrap material.

(d) Spoiled and defective materials.

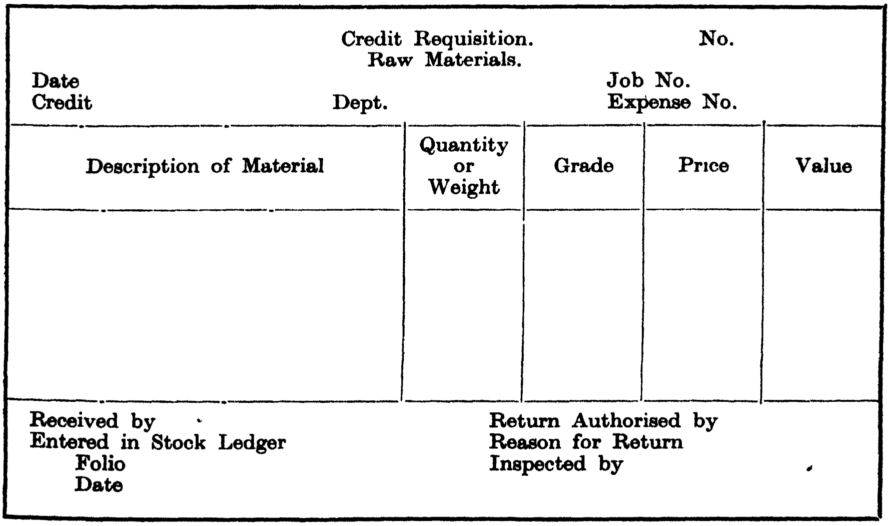
(e) Rejected products, or parts.

(a) and (b) are generally catered for by means of the Materials Returned Form which is completed by the person returning the material or by the storekeeper. (See Figure No. 19.) This is in duplicate, one copy being retained by the storekeeper and the other sent to the stores ledger clerk, who computes the cost of the material returned, enters it in the stores ledger, and, as a credit, on the Material Consumed Summary. It is then forwarded to the cost clerk, who enters it as a credit to the Production, Standing, Betterment or Repair Order concerned. The Materials Returned Form should include the following particulars:—

(a) The form number and the date.

FIGURE No. 19.

MATERIALS RETURNED FORM.



Credit Requisition. No.
Raw Materials.
Date Job No.
Credit Dept. Expense No.

Description of Material	Quantity or Weight	Grade	Price	Value

Received by
Entered in Stock Ledger
Folio
Date

Return Authorised by
Reason for Return
Inspected by

(b) The Production, Standing Order, Plant or Repair Order number to be credited.
(c) The Stores Account to be charged.
(d) The quantity and kind of material.
(e) The department or unit returning the material.
(f) The signature of the person receiving it.

3. *Returned Scrap Form.*

Scrap material is in general often accounted for in a similar manner to other returned material, but the exact treatment depends upon the type and value of the scrap. (See Figure No. 20.) It may be catered for by being:—

(a) Returned to the store for re-issue in a similar way.
(b) Returned to the store for inspection, sorting and grading, so as to salvage what can be used for future production.
(c) Returned to a by-products department for re-issue.
(d) Sold at the best market price obtainable.
(e) Sent away as of no value.

Depending upon the amount and value, scrap is frequently not credited to the Production or other Order originally debited, but is credited to a Standing Order raised for such purpose, the total of which is used to decrease manufacturing expense.

The Returned Scrap Form should contain the following particulars:—

(a) The form number and date.
(b) The Production, Standing Order, Plant or Repair Order number to be credited.
(c) The Stores account number to be charged.
(d) The quantity, kind of scrap, unit value and total value.

FIGURE No. 20.

RETURNED SCRAP FORM.

From Dept.		Scrap Return.	No. Date Production Order No. (if any)		
No. of Pieces	Weight	Part Nos. or Description	Material	Operation when Scrapped	Reason for Scrapping
Replaced by			Returned by Authorized by		

(e) The department returning the scrap.

(f) The signature of the person receiving it.

4. *Spoiled Materials Form.*

This form caters for spoiled and defective materials, and sometimes for rejected products or parts. Spoiled material sometimes requires special treatment on account of its nature. (See Figure No. 21.) The form should be ruled so as to provide for the following particulars:—

(a) The form number and the date and by whom the spoiled material has been returned.

(b) The quantity, kind of material, and, wherever possible, the spoilage value.

(c) Provision for the necessary accounting records, such as the debits to Stores (Spoiled Materials), and to the Standing Order covering Spoiled Materials, together with the credits to the Production number or the Standing Order number.

When the spoiled material is returned, an entry must be made in the appropriate Spoiled Materials account in the Stores Ledger, and the Materials Consumed Summary should be credited. The Cost Clerk must also credit the production or standing order on which the spoilage occurred with the original value of the material issued. It will be noted that the cost of the order is reduced to the extent of the complete value of the material when it was spoiled. The difference between the original and the spoiled value is generally debited to a Standing Order for spoiled materials.

FIGURE No. 21.

SPOILED MATERIALS FORM.

Spoiled Material Report — No. ....
Returned by .... — Date ....
Department ....

Code No.	Quantity or Weight	Description of Material	Spoilage Value	Reason for Spoilage

Debit Stores, Spoiled Materials..................... .. — Suggested Use..............
Debit Standing Order No. 1016 — ....
(Material Spoilage) . ... — ....
Credit Production Order No....................... — Received by
Credit Standing Order No..........................

Perpetual Inventory versus Physical Inventory.

Many arguments are presented from time to time concerning the respective merits of the Perpetual Inventory (a material control system) and the Physical Inventory (i.e., stocktaking). Unfortunately, the basis for these arguments is generally incorrectly chosen. It is not a question of the advantage of the so-called Perpetual Inventory over the Physical Inventory—or vice versa—for such an argument presupposes that the Perpetual Inventory is limited to one principal use, i.e., a means for establishing the valuation of stocks for administrative and financial purposes. This assumption is hardly a fair one, because in most instances the material control system will justify itself even though its use for financial purposes (the only principal functions it has in common with the Physical Inventory) is not pursued. The chief value of the Perpetual Inventory, with its necessary forms and procedures, lies in its ability to furnish at all times detailed and current information pertaining to each material, and the fact that the preparation of monthly profit and loss statements is facilitated.

The following are the advantages of the Perpetual Inventory over the Physical Inventory :—

1. It is not necessary to shut down the plant one or more times a year. Therefore, loss due to the cessation of production and the usual large expense of taking a physical inventory is eliminated. (This is, however, often done even where perpetual inventories are in operation as will be seen hereunder.)
2. Actual counting of stock can be done by degrees rather than at one time. Hence the Perpetual Inventory can be made more accurate than the Physical Inventory.
3. Storekeepers are more careful in the treatment of material if they know that their stock is subject to check without notice.
4. Differences between material ledger quantities and actual counts can be traced down more easily and within such time as to correct irregular practices.
5. Results of an inventory can be obtained more quickly than in the instance of Physical Inventory.
6. Adjustment to the Stock Control account can be made monthly instead of but once a year. Thus the profits shown on the monthly report of operation will be more correct and in accordance with actual facts.
7. The preparation of monthly profit and loss accounts is facilitated.

In comparison with the above, the following are usually considered as the advantages of the Physical Inventory:—

1. It serves as a complete verification of material, even if a material control inventory is kept.
2. It will often give more accurate results than a book inventory in the case of bulk materials.
3. It sometimes gives more accurate results in the case of work-in-process than book records will give.
4. It affords a time for returning to the various storerooms all excess materials in the various operating departments.
5. It affords a time when the plant may be cleaned up and put in effective operating condition for another year.

The best solution lies in a combination of the two methods. In spite of the fact that many excellent control methods are now being operated by progressive concerns, and furthermore that, theoretically, it would appear that the need for physical inventories would thus be eliminated, most concerns have not given up the taking of physical inventories once or perhaps twice a year. This is largely brought about because so many conditions surround the movement of materials that even the most carefully maintained stock records vary by too great an amount from the actual inventory. The Physical Inventory is retained in the case of retail stores, because of the usually accepted method of stock treatment.

It is necessary to say that the one factor above all others which makes a Physical Inventory necessary is the human element—something that has largely defied all attempts to reduce it to any kind of a constant factor. Although a good material control system with its material ledgers is a real necessity at all times during an operating period, and while it will repay its user time after time by savings effected in stock reductions, material losses, and uninterrupted production, there is much to be said for retaining the physical stocktaking, and it appears that the great majority of concerns which have material control systems will continue to take stock; those without such systems will always require stocktaking.

Purposes of Stocktaking.

Stocktaking should be so planned as to allow the results to be used for the following purposes:—

Financial.

1. To make possible preparations of the Balance Sheet, Profit and Loss Account, etc.
2. To ensure economy in stocks.
3. To adjust depreciation and obsolescence and their effect upon stock values.
4. To prepare insurance covers.
5. To calculate stock turnovers.

Manufacturing.

1. To correct and adjust stores ledgers with the physical inventory and to reconcile the controlling accounts.
2. To revise Production Records and Schedules, especially with respect to material which records show as being in process of manufacture.
3. To discover obsolete materials used in production supposed to have been discontinued.
4. To determine any unbalanced condition of raw materials, parts and assemblies.
5. To show the amount of obsolete stock on hand caused by engineering or specification changes on current models or products.
6. To determine whether the indirect materials and consumable tools are in excess of requirements.
7. To determine an overstock of spare parts which might be released for the manufacture of products.

8. To determine shortages in spare parts, causing poor service to customers.

Purchasing.

1. To prevent overpurchasing, with the resultant excessive stocks.
2. To enable the purchasing department to learn of shortages of stocks which could be ordered at once.
3. To render information concerning obsolete materials on hand, which may be disposed of to other concerns.
4. To notify the purchasing department of all rejected materials which, because of defects, should have been returned to the seller.
5. To report materials owned by the company on consignment at other plants for manufacture, or held by other concerns for storage, etc.

Sales.

1. To show the quantities of finished products at different locations.
2. To show the quantities of products held outside the warehouse.
3. To compare unfilled orders with stocks on hand.
4. To enable concentration to be made on those lines of which large stocks are held.

Planning the Stocktaking.

In planning a stocktaking of a very comprehensive stock, it is sometimes advisable to set down a definite programme which would take into account the following:—

1. Materials to be included.
2. Materials not to be included.
3. Materials to be covered by estimating and approximation.
4. Materials in transit—inward.
5. Materials in transit—outwards.
6. Rejected materials.
7. Obsolete materials.
8. Scrap.
9. Consumable tools.
10. Operating. maintenance and repair supplies.
11. Packing and shipping supplies.
12. Advertising materials and stationery.
13. Consigned materials owned by others.
14. Consigned materials owned.
15. Materials to be counted and reported upon, not to be included.
16. Classification and status of material.
17. Location of materials held.
18. Internal movements of materials during stocktaking.
19. Receipts of materials during stocktaking.
20. Methods of counting, weighing and measuring materials.

Furthermore, the following procedure may simplify the stocktaking work:—

1. **Arrange the stocks in orderly fashion, segregating special or old stocks for separate listing.**
2. **Sectionalise the stores to facilitate an appropriate division of recording labour.**
3. **Arrange for two persons to work together—one counting and one recording on specially prepared, headed and numbered stocktaking sheets—a "tear off" tag to be used.**
4. **Arrange for check as soon as possible after the first count, stock sheets to be forwarded as quickly as possible thereafter.**
5. **Transfer the stock sheets, list and assemble these, then record the book stock figures, compare the actual and book records and check as soon as possible any discrepancies.**
6. **Where possible, do not allow any person having the handling of stock to record the inventory.**
7. **When the actual stocktaking is completed, arrange for the stock to be priced, extensions completed and final figures obtained.**

Work in Process.

This schedule should set forth the full necessary particulars regarding all work started but not completed at the time of the stocktaking. Generally the following information would be included:—

1. Location.
2. Machine or process where material is located.
3. Lot number.
4. Lot quantity.
5. Operations performed.
6. Last operation performed.

A Stocktaking Card suitable for Work in Process is shown in Figure No. 22.

Valuation of Stocks.

The basis of Cost or Market, whichever is the lower, is generally accepted. It requires first of all the establishment of the actual cost and the market value of each item of stock (at least in the main). Very often, in practice, consideration of this factor is limited to those items which are of large value, and particularly large stocks of bulk goods. This basis of (a) cost, if market is greater than cost, and (b) market value, if such value is less than cost, accomplishes two main results:—

1. It places a conservative value on the inventory for balance sheet purposes.
2. It affords the establishment of correct profits between one period and another.

Whilst best accounting practice generally requires that stocks be priced at market value, where market price is less than cost, it does not favour the apparently logical reasoning that, when market is greater than cost, market values should be used. It may be the case that there is just as

FIGURE No. 22.

STOCKTAKING CARD.

No. ....

Stocktaking Date

Part No. ....

Department ....

Quantity ....

Operations Performed...

Checked by

……

Part No. ....

Part Name.. ....

Operations Performed...

Quantity ....

Location ....

Department ....

Model ....

Remarks ... .

....

Counted by...

Supervisor..........................

much possibility of additional profits being realised in the subsequent period as the loss due under the reverse circumstances, but this does not affect the recognised principle of Cost or Market. Incidentally, whilst universally recognised, the rule is not really as specific as it should be, owing to the definitions which can be placed on the terms "cost" or "market."

Irrespective of the actual method adopted in valuing stocks, the following principles are largely accepted:—

1. Stocks should not be valued at more than their probable realisation value.
2. Slow moving, obsolete and unsaleable stocks should be written down to a price at which no subsequent loss need be expected.
3. Profits should not be taken on unsold stocks.
4. Stocks at the beginning and end of the period should be valued on the same basis.
5. The method of valuation used should be suitable for the industry affected.

CHAPTER 5.

MATERIALS—COST ACCOUNTING PROCEDURE.

Values in Stores Requisitions.

As mentioned in the previous chapter, the Stores Requisition is used for posting to the Materials Ledger, but sometimes only quantities are entered. If it is desired that control be exercised by the financial books, prices and values must be included. Quantities are most important from the purchasing, storekeeping and production angles, and values from the accounting and financial. The following are the matters to be considered when deciding whether values should be inserted:—

1. What extra clerical work will be involved by including values? (This may be considerable, and may lead to the conclusion that the advantages are not sufficient to offset the extra labour required.)
2. If values are not included, what methods will be adopted to value stores on hand?
3. Will it be possible to reconcile Stores on Hand and Stores Control accounts without values?
4. What discrepancies will arise and what accuracy will be sacrificed by the omission of values?
5. What valuable information will be denied to executives if the values are not inserted?

When the clerk receives the Stores Requisition for entering in the stores ledger, his first duty is to determine at what price the goods shall be entered. The stores ledger accounts would show the cost of the various parcels of goods received in the Received Column. This would generally be the invoice price less trade discounts, plus freight, duty, primage, and if desired cartage, etc., where these are applicable. In some cases a deduction is made for cash discounts and an addition for stores department expense applicable to the goods. Unit costs would then be arrived at on the basis of the total cost.

Goods may be issued from stores in one of two ways:—

(a) From an actual lot identifiable both in the storeroom and through the stores ledger.

(b) From general stock not identifiable in any specific way. (This does not exclude the adoption of the principle that oldest stock should generally be used first.)

PRICING OF STORES REQUISITIONS.

The following are the main methods of pricing stores requisitions:—

The Original Cost Method.

Under this method the requisition is costed at the actual cost of the particular lot from which the issue was made. This would need actual identification. (See Figure No. 23.) Frequently this method would be similar to the next method.

FIGURE No. 23.

PRICING STORES REQUISITIONS—ORIGINAL COST METHOD.

STORES LEDGER CARD.

"A" Raw Materials.

194—		£	s.	d.	194—		£	s.	d.
Jan. 2nd	To Purchases (a) 20 @ £1	20	0	0	Jan. 5th	By Issue (a) 15 @ £1	15	0	0
4th	,, ,, (b) 25 @ £1/2/0	27	10	0	15th	,, ,, (b) 10 @ £1/2/0	11	0	0
18th	,, ,, (c) 20 @ £1/2/6	22	10	0	20th	,, ,, (c) 8 @ £1/2/6	9	0	0
					31st	,, Balance	35	0	0
		£70	0	0			£70	0	0
194—		£	s.	d.					
Feb. 1st	To Balance								
	(a) 5 @ £1	5	0	0					
	(b) 15 @ £1/2/0	16	10	0					
	(c) 12 @ £1/2/6	13	10	0					

"First in First Out" Method.

This method is based on the assumption that theoretically material should always be issued from the oldest lot on hand, and should therefore be priced at the cost at which that lot was placed in stock. Under this method, the cost of the first lot of materials received is used as the price of the materials issued until the issues amount to as much as the receipts on that lot. Each succeeding lot is treated in a similar manner. When an issue of material covers two lots which were received at different prices, a separate cost rate would be used for the amount issued from each lot. It will be seen that if stores are in actual fact always issued from the oldest stock, this method would be the same as the first method. (See Figure No. 24.)

FIGURE No. 24.

PRICING STORES REQUISITIONS—"FIRST IN FIRST OUT" METHOD.

STORES LEDGER CARD.

"A" Raw Materials.

194—		£	s.	d.	194—		£	s.	d.
Jan. 2nd	To Purchases 20 @ £1	20	0	0	Jan. 5th	By Issue 15 @ £1	15	0	0
4th	,, ,, 25 @ £1/2/0	27	10	0	15th	,, ,, {5 @ £1	5	0	0
18th	,, ,, 20 @ £1/2/6	22	10	0		{5 @ £1/2/0	5	10	0
					20th	,, ,, 8 @ £1/2/0	8	16	0
					31st	,, Balance	35	14	0
		£70	0	0			£70	0	0
194—		£	s.	d.					
Feb. 1st	To Balance								
	12 @ £1/2/0	13	4	0					
	20 @ £1/2/6	22	10	0					

Average Cost Method.

The principle underlying this method is that when different parcels of goods are received in store, identity is largely often lost and an issue cannot be made from the first lot of goods received. The issue is, therefore, taken to be made from an average of all goods in stock. One of the reasons urged in support of this method is that a stock of materials should actually be valued at an average and should therefore be issued at an average value. The total cost of all material on hand, divided by the quantity of units on hand, would give the average cost per unit, and this would be the figure used for pricing issues of material. This average would remain in operation until further material was received at a different unit cost, whereupon it would be necessary to arrive at a fresh average. One of the disadvantages of this method is that where there are constantly changing prices, more clerical work is entailed than with the "first in first out" method. It does, however, mean that a more uniform value is placed on materials issued, and avoids the possibility of two rates having to be used in connection with a single issue of materials. (See Figure No. 25.)

FIGURE No. 25.

PRICING STORES REQUISITIONS—AVERAGE COST METHOD.

STORE LEDGER CARD.

" A " Raw Materials.

194—		£	s.	d.	194—		£	s.	d.
Jan.	2nd To Purchases 20 @ £1	20	0	0	Jan.	5th By Issues 15 @ 21/1⅓	15	16	8
	4th ,, ,, 25 @ £1/2/0	27	10	0		15th ,, ,, 10 @ 21/1⅓	10	11	1
	18th ,, ,, 20 @ £1/2/6	22	10	0		20th ,, ,, 8 at 21/9-7/10	8	14	6
						31st ,, Balance	34	17	9
		£70	0	0			£70	0	0
194—		£	s.	d.					
Feb.	1st To Balance 32 @ 21/9-7/10	34	17	9					

The Inventory Method.

Under this method, the value of the opening stock is used to value materials issued throughout the month. When the issues do not exceed the inventory at the beginning of the month and there has been no change in cost on purchases during the month, this would be the same as the Average Cost method. If the issues exceed the opening stock or if a change in cost has occurred, there will be an error in the valuation of the closing stock, which would have to be corrected. This method has a number of disadvantages and, except in special cases, is not recommended. (See Figure No. 26.)

FIGURE No. 26.

PRICING STORES REQUISITIONS—INVENTORY METHOD.

194—		£	s.	d.	194—		£	s.	d.
Jan.	2nd To Purchases 20 @ £1	20	0	0	Jan.	5th By Issues 15 @ £1	15	0	0
	4th ,, ,, 25 @ £1/2/0	27	10	0		15th ,, ,, 10 @ £1	10	0	0
	18th ,, ,, 20 @ £1/2/6	22	10	0		20th ,, ,, 8 @ £1	8	0	0
						31st ,, Balance	37	0	0
		£70	0	0			£70	0	0
194—									
Feb.	1st To Balance 32 @ £1/3/1½	37	0	0					

(*Note* :—The stock on hand is valued at £1/3/1½ which is higher than the price of any purchase and should therefore be adjusted. This method is not recommended)

The Market Price Method.

This can take one of two forms. Either issues can be charged at market prices and an adjustment made at the end of the month, or issues at market price can be charged to production orders, while issues as far as the stores ledger is concerned would be entered at the average cost or "first in first out" cost. Here again an adjustment would be necessary. The object underlying this method is to arrive at the efficiency of the purchasing department, as the balance of the adjustment account will show which materials used cost more or less than the market prices for the period. (See Figure No. 27).

FIGURE No. 27.

PRICING STORES REQUISITIONS—"MARKET PRICE" METHOD.

Assume 60 tons pig iron purchased at 6d. per lb. in the previous July. The market price was: January 6d. February 6½d. March 7d. April 6½d. June 7½d.

STORES LEDGER CARD.

PIG IRON.

		£	s.	d.			£	s.	d.
194—		£	s.	d.	194—		£	s.	d.
Jan. 1st	To Balance 10000 lbs. @ 6d.	250	0	0	Jan. 31st	500 lbs @ 6d.	12	10	0
					Feb. 28th	1000 „ @ 6½d.	27	1	8
					Mar. 31st	500 „ @ 7d.	14	11	8
					Apr. 30th	1000 „ @ 6½d.	27	1	8
					May 31st	1000 „ @ 7d.	29	3	4
					Jun. 30th	1000 „ @ 7½d.	31	5	0
						Balance	108	6	8
		£250	0	0			£250	0	0
194—		£	s.	d.					
July 1st	To Balance	108	6	8					

The "Last in First Out" Method.

This method, as its name suggests, is based upon the principle that the last stock received is the first to be used. Its advocates state that this method gives closer results because existing material costs more often enter into production costs. Its opponents state that its weaknesses are:

1. It is not realistic.
2. It tends to flatten out peaks and valleys of earnings and shows a false stability.
3. It subordinates the Balance Sheet to the statement of operations.
4. It is primarily designed for income tax purposes.

As the result of investigations in U.S.A., the Committee on Federal Taxation of the American Institute of Accountants to the United States Treasury Department on September 1, 1938, stated:—

"The last-in first-out or similar inventory methods would appear to be appropriate when.—

1. The inventory is of relatively greater importance than in other industries as evidenced by the large ratios to other assets and by the fact that it consists of basic or homogenous goods which form a substantial part of the cost of the products sold.
2. Inventory turnover is slow either because of length of process or conditions of merchandising.
3. Raw Materials prices and Finished Goods prices tend to run parallel.
4. The cost of raw material is such an important factor in the conduct of the business that fluctuations in raw material prices cannot be ab-

FIGURE No. 28.

PRICING STORES REQUISITIONS—"LAST IN FIRST OUT" METHOD.

		£	s.	d.			£	s.	d.
194—		£	s.	d.	194—		£	s.	d.
Jan. 2nd	To Purchases 20 @ £1/0/0	20	0	0	Jan. 5th	By Issues 15 @ £1/2/0	16	10	0
4th	„ „ 25 @ £1/2/0	27	10	0	15th	„ „ 10 @ £1/2/0	11	0	0
18th	„ „ 20 @ £1/2/6	22	10	0	20th	„ „ 8 @ £1/2/6	9	0	0
					31st	„ Balance	33	10	0
		£70	0	0			£70	0	0
194—		£	s.	d.					
Feb. 1st	To Balance.								
	20 @ £1/0/0	20	0	0					
	12 @ £1/2/6	13	10	0					

sorbed in the ordinary operations of business, making it necessary, so far as possible, to match purchases and sales (or sales and purchases) in a manner similar to that in which hedging operations in an available market may be used." (See Figure No. 28.)

Replacement Cost.

Issues of materials are charged out at the estimated replacement cost. This may vary from time to time and the price would vary accordingly. This method has some characteristics similar to the "last in first out" method. (See Figure No. 29).

FIGURE No. 29.

PRICING STORES REQUISITIONS—REPLACEMENT COST METHOD.

194—		£	s.	d.	194—		£	s.	d.
Jan. 2nd	To Purchases 20 @ £1/0/0	20	0	0	Jan. 5th	By Issues 15 @ £1/2/0	16	10	0
4th	,, ,, 25 @ £1/2/0	27	10	0	15th	,, ,, 10 @ £1/2/6	11	5	0
18th	,, ,, 20 @ £1/2/6	22	10	0	20th	,, ,, 8 @ £1/2/6	9	0	0
					31st	,, Balance	33	5	0
		£70	0	0			£70	0	0
194—		£	s.	d.					
Feb. 1st	To Balance	33	5	0					

Standard Cost Method.

This method is considered in detail when dealing with Standard Costs. Briefly, it involves a determination of standard quantities and values and pricing issues in accordance with such principles.

FIGURE No. 30.

PRICING REQUISITIONS—COMPARATIVE STATEMENT OF METHODS.

Values of Stock at 1st February, 1943.

	£	s.	d.
Original Cost Method	35	0	0
" First in First Out " Method	35	14	0
Average Cost Method	34	17	9
Inventory Method	37	0	0
Replacement Cost Method	33	5	0
" Last in First Out " Method	33	10	0

Comparison of Methods.

Each of the foregoing methods could result in a different value charged into production and a different value of stock on hand. This latter factor is shown in Figure No. 30. In choosing a method full consideration should be given to the particular circumstances of the case.

Entries in General and Cost Ledgers.

The exact relationship between General and Cost Ledgers forms the subject of a later chapter but the various entries in these ledgers are set out hereunder. The following records should be kept:—

(a) *Materials Ledger.*

This is composed of the various ledger sheets covering each particular store. (See Figure No. 31). The total of the balances of these Stores accounts should equal the balance of the Materials Control account.

FIGURE No. 31.

STORES LEDGER.

Item

Code No.

Stores Location

Maximum
Minimum
Ordering Point

Ordered			Received					Apportioned			Issued					Balance		
Date	Purchase Order No.	Quantity	Date Received	Receiving Order No.	Quantity	Total Cost	Unit Cost	Date	Apportioned Order No.	Quantity	Date	Requisition No.	Quantity	Price	Value	Quantity	Value	Unit Cost

(b) *Summary of Materials Received.*

This would be received from the Stores Department and would be entered from the Receiving Reports. These latter would also be used for entering into the appropriate Stores account in the Materials Ledger and the totals would be debited to the Materials Control account in the General Ledger. (See Figure No. 32.)

FIGURE No. 32.

SUMMARY OF MATERIALS RECEIVED.

Summary of Materials Received Form.

Date	Receiving Report No.	Production Order No.	Value	Bulk Store	Raw Materials Store	Parts Store	Finished Goods Store

(c) *Summary of Materials Issued.*

The stores requisitions covering issues of materials are summarised daily, weekly or monthly, after having been entered to the appropriate Stores account in the Materials Ledger. The total of the requisitions could be credited to the Materials Control account in the General Ledger. (See Figure No. 33.)

(d) *Scrap Report.*

A list of scrap or spoiled work is prepared weekly or monthly and the necessary entries are made in appropriate Stores accounts in the Materials Ledger. The necessary entries would also be made in the Materials Control account in the General Ledger. (Refer Figures Nos. 20 and 21.)

Figures Nos. 34 and 35 show the various entries made in the General Ledger and the appropriate cost records. Figure No. 36 shows the various ledger postings in both subsidiary and control records.

FIGURE No. 33.

Summary of Materials Issued.

Date	Requisition No.	Amount	Job No 33	Job No. 34	Job No. 35	Job No. 36	Job No. 37	Job No. 38	Job No. 39	Standing Order No.	Amount	Remarks

FIGURE No. 34.

MATERIALS—GENERAL AND COST LEDGER ENTRIES.

	Original Financial Record	Entry in General Ledger	Original Cost Record	Entry in Cost Records
Materials purchased for Stores	Entry in Voucher Register (or Purchase Journal)	Materials Control A/c To Sundry Creditors	Stores Received Report	Debit Entry in Applicable Stores Ledger Card.
Payment of Invoice	Cash Book	Sundry Creditors To Cash	Nil	Nil
Materials purchased returned to Vendor	Credit Entry in Voucher Register (or Purchase Journal)	Sundry Creditors To Materials Control A/c.	Materials Returned Form	Credit Entry in applicable Stores Ledger Card.
Direct Material Issued from Stores to Production	Monthly Summary of Materials Issues	Materials in Process To Stores Control A/c.	Stores Requisition	Debit Entry in Materials Section of appropriate Production Order. Credit Entry in Stores Ledger Card.
Indirect Materials Issued from Stores to Production	Do.	Manufacturing Expense in Process To Materials Control A/c.	Stores Requisition	Debit Entry in Materials Section of appropriate Standing Order. Credit Entry in Stores Ledger Card.
Direct Materials returned to Store	Monthly Summary of Returns to Store	Materials Control A/c To Materials in Process	Credit Stores Requisition	Debit Entry in Stores Ledger Card. Credit Entry in Materials Section of appropriate Production Order.

FIGURE No. 36.

MATERIALS CONTROL—ACCOUNTING PROCEDURE.

Ordering Point or Minimum Stock Figure Reached or
New Materials Required, resulting in Storekeeper issuing a Request to Purchase.

REQUEST TO PURCHASE.

To Purchasing Agent— No. ....
Please purchase for.........Dept. No..........Date............
Deliver to....................at....................by....................

Quantity	Item No.	Code No.	Description	Quality	Remarks
1 gross	246	A27	Oil gauges	Special	

Upon receipt of Request to Purchase, Purchasing Agent ascertains who can supply, chooses certain firms and sends a Request for Quotation.

REQUEST FOR QUOTATION.

No............ Date............

Please quote your best price, terms, delivery etc. for the undermentioned goods etc.

Quantity Required	Grade	Description of Goods	Price	Terms	Delivery Date
1 gross	Special	Oil Gauges			

After considering quotations seller is decided upon and Purchasing Agent issues a Purchase Order.

PURCHASE ORDER.

No............ Date............

To...
....
....

Please supply the following goods in accordance with the terms and conditions on the back hereof and deliver same to our works etc.

Item No.	Quantity	Grade	Description of Goods	Price	Terms	Delivery Date
246	1 Gross	Special	Oil Gauges	£30/-/- Gross	Less 2½% 30 days	10th May 194......

When goods are received the receiving clerk checks and counts (sends to Laboratory if needed) and compares with his copy of Production Order, then issues a Materials Received Note.

MATERIALS RECEIVED NOTE.

No............ Date...........

Received from ....
.... Purchase Order No............
....

Quantity	Item No.	Grade	Description	Remarks
1 Gross	246	Special	Oil Gauges	Good condition except 1 doz.

As 1 Doz. are damaged, the Storekeeper returns these to the seller and prepares a Returned to Vendor Form.

RETURNED TO VENDOR FORM.

No............ Date...........

The following materials have to-day been returned to
....
....
....

Quantity	Description	Unit Cost	Value	Reason
1 doz.	Oil Gauges	£30 Gross	£2 10 0	Glasses broken

The goods leave the Receiving Section with the Materials Received Note and are checked and stored, the Receiving Note then being forwarded to the Purchasing and Accounting Sections where it is entered in the Stores Ledger Card.

STORES LEDGER CARD.

Item—Oil Gauges—Special Max..........................
Min..........................
Ordering Point...........

Ordered			Received		Apportioned		Issued		Balance	
Date	Partic.	Qty.	Qty.	Amount	No.	Qty.	Qty.	Amount	Qty.	Amount
1/1/194	A421	1 gross	1 gross	30 0 0	216	$\frac{1}{12}$ gross	$\frac{1}{12}$ gross	2 10 0	$\frac{11}{12}$ gross	27 10 0

The Seller forwards an Invoice and a Credit Note which are forwarded to the Purchasing Agent and then to the Accounting Section.

INVOICE.

No............ Date...........

....

....

....

Dr. to

A. B. Manufacturing Co.

....

....

1 Gross	Oil Gauges	£30 0 0

The Accounting Section enter the Invoice and Credit Note in the Voucher Register.

VOUCHER REGISTER.

No............ Date...........

Date	Name	Voucher No.......	Amount Payable	Debit Undermentioned A/c.		
				Raw Material	Fin. Parts	Remarks
1/1/194—	A.B.Mfg.Co.	245	30 0 0		30 0 0	
			£5500 0 0			

All papers relative to the transaction are then filed and in due course the account is paid. At the end of a period postings are made from the Voucher Register to the Raw Materials Control A/c.

RAW MATERIALS CONTROL A/c.

Debit			Credit		
Date		Amount	Date		Amount
31/1/194—	To Purchases	£5,500	31/1/194—	By Issues	£1,400

When the materials are available work is commenced upon a Production Order.

PRODUCTION ORDER.

Assembly Dept......................................No. ....

Date............

Please assemble the undermentioned articles. Work should commence on . . . . and finish on . . . .

Quantity	Description	Drawing No.	Other Particulars
12	Engines V14/2A		

Upon Receipt of the Production Order the departmental foreman ascertains the materials required from the planning dept. list and forwards through to the Store Dept. the Materials Requisition.

MATERIALS REQUISITION.

Date............ No. ....

Charge to....................Dept..................Job No.........

Description of Material	Quantity or Weight	Grade	Price	Value
Oil Gauges	12	Special	50/- doz.	2 10 0

The Storekeeper checks the requisition, ascertains if it has been correctly authorised then issues the goods, marks the Requisition and finally forwards it to the Accounting Section, where values are entered by the Stores Ledger Clerk on the Material Requisition, and particulars are entered in the Issued Section of the Stores Ledger.

STORES LEDGER CARD.

Item—Oil Gauges—Special Max..........................

Min..........................

Ordering Point...........

Ordered			Received		Apportioned		Issued		Balance	
Date	Partic.	Qty.	Qty.	Amount	No.	Qty.	Qty.	Amount	Qty.	Amount
1/1/194	A421	1 gross	1 gross	30 0 0	216	$\frac{1}{12}$ gross	$\frac{1}{12}$ gross	2 10 0	$\frac{11}{12}$ gross	27 10 0

The copy of the Material Requisition is forwarded to the Cost Section where it is entered in the appropriate Cost Sheet.

COST SHEET.

Job No............
Commenced........................
Finished ....

No. ....
Date............

Store Requisition	Materials Cost	Job Time Card	Wages Cost	Dept.	Expense Summary	Expense Cost
123	2 10 0					

At end of period (e.g. months) all requisitions are summarized in a Materials Requisition Summary.

SUMMARY OF MATERIALS REQUISITIONS.

Order No.	Department	Raw Materials	Finished Parts
123			2 10 0
		£1400 0 0	£2200 0 0

The total of Materials Requisitions are then journalised in the Cost Journal.

COST JOURNAL.

Date		Debit	Credit
31/1/194—	Materials in Process	£3600 0 0	
	To Raw Materials		£1400 0 0
	To Finished Parts		£2200 0 0

Postings are then made by the Costing Section, the total of the materials and parts entering into production being posted to the Materials in Process A/c.

MATERIALS IN PROCESS A/c.

Date		Amount	
Jany. 1/31	Material Requisition	£3600 0 0	

The other postings are to the Raw Materials and Finished Parts. Control A/cs.

RAW MATERIALS CONTROL A/c.

Debit			Credit		
Date		Amount	Date		Amount
31/1/194—	To Purchases	£5500	31/1/194—	By Issues	£1400

Objections to Materials Control.

The objections to Materials Control are largely confined to two matters:—

(1) Cost of installing a system and operating it.

(2) The fact that systems are not always reliable.

In relation to the first of these there can be little doubt that many control systems are too costly to operate for the amount of accurate information contained. This is a matter which must be considered in relation to the particular circumstances, but it will very often be found that the advantage of having monthly financial statements (which is facilitated by Materials Control) is alone worth the necessary outlay in relation to such control. The main reasons for the second factor are, firstly, the failure to instruct employees properly, and, secondly, improper supervision. It should be realised that there is often considerable work involved in Materials Control, and there must be sufficient staff to carry out this duty in addition to all other clerical work.

Differences between the book balance of material on hand and the actual material count can be divided into two groups:—

1. Differences caused by errors in the treatment of the material control records and posting.
2. Differences caused by the treatment of the material itself.

Within the first class are:—

(a) Failure to post receipts of material.

(b) Failure to post issues of material.

(c) Failure to post adjustments.

(d) Failure to post return of material.

(e) Errors in posting.

(f) Posting to wrong account.

(g) Lost material receipts, requisitions, returns to stores, and adjustment slips.

Within the second class are:—

(a) Errors made in receiving material into stores.

(b) Errors made in issuing material—over- or under-issues.

(c) Loss of material due to any one or combination of the following:

    (1) Theft.
    (2) Deterioration.
    (3) Breakage.
    (4) Shrinkage.
    (5) Seepage.
    (6) Lack of care.

(d) Material misplaced and lost in storage.

(e) Incorrect identification and description of materials counted.

It will be readily seen that the causes within the first class are clerical irregularities and these may, therefore, be largely prevented by methods which result in an arithmetical check, by means of control figures. The causes of differences falling within the second class may be largely removed by proper methods of storekeeping.

CHAPTER 6.

LABOUR—METHODS OF REMUNERATION.

Various systems have been devised for remunerating labour. The most common method is "so much per day" or "so much per week." This is generally termed a "daily or weekly time wage rate." Fundamentally, all methods are divisible into two classes:—

1. Payment by time—Time Rate.
2. Payment per piece—Piece Rate.

Co-Partnership, Profit Sharing, Premium Bonus, etc., and any variants of these are ancillary to these two main divisions. All devices involving payment by results are variants of Class 2, and it should be borne in mind when comparing the various methods of rewarding labour that, with the exception of the ordinary Time Rate, they are based on a predetermined standard and payment is made on a basis of attainment.

The subject of payment by results is one of extreme difficulty, and is very contentious. Many of the greatest minds of every country have been engaged upon the subject over a considerable period, and no degree of unanimity has been reached. The only points of agreement are that the reward should be commensurate with the effort expended and the efficiency attained, and that there should be a guaranteed minimum wage.

U.S.A. EXPERIENCE.

In 1924, the National Industrial Conference Board of U.S.A. undertook a study of over 1000 plants employing over 400,000 workers and found that 44 per cent. were making use of some incentive plan.

In 1927, the Sherman Corporation made a survey of over 1100 companies in U.S.A. employing over 500,000 workers and found 49 per cent. using incentive plans. They found that in plants devoted to automatic products, 65 per cent. used incentive methods, which fact was stated to have a real connection with the outstanding efficiency attained in that group.

In 1928, the National Metal Trades Association (U.S.A.) surveyed 672 of their members' plants and found that 54 per cent. used some form of Incentive Plan.

The traditional employer viewpoint was found to be a consideration of wages as an element of cost expense necessary to manufacture or market an article or product. The employer believed, and the belief was often well founded, that employee output in quantity and quality was often not commensurate with the money paid for it. To the employee, on the other hand, the pay-envelope has been and presumably always will be the supreme ambition. The Wage Incentive system is an attempt to reconcile both viewpoints. It makes possible increased production and lowered costs, hand in hand with greater employee earnings. The increased earnings create greater consumer purchasing ability. Unfortunately such advantages are accompanied by some disadvantages and weaknesses.

HOW WAGE INCENTIVE SYSTEMS ACT.

Incentive encourages, stimulates, and spurs into action. Men work because they desire the additional advantages offered by the system. Much of the holding back that is acknowledged to occur in industry and business is because employees lack incentives. Knowing that there is to be some share in savings and profits, it is frequently but a question of time and effort until most of the workers are able to control and regulate their activities and influence the actions of others to bring about results which may have been thought impossible previously.

The installation of Wage Incentive systems means more knowledge and more studying than is entailed in an understanding of wage payment plans by themselves. The extra pay features of these plans, it is true, appeal to certain human desires, such as pride, self-preservation, advancement, home, pleasure or money, the realisation of which awakens interest and impels action, but in order to pave the way for these desires through a wage incentive system, intelligent and painstaking preparatory work is necessary.

Certain important knowledge is needed by the man who is to direct the installation of Wage Incentive systems, namely, knowledge that will enable him to set up conditions which are essential pre-requisites, which result in maximum benefits to the employer, and which enable the worker to see that definite rewards and accomplishments are bound to follow regularly as a direct result of performing work above a certain definite standard.

Incentives to employees work out in a practical way only when they are founded on the results of specific types of analysis, classification and standardization, coupled with the desire to give each person a just reward for his service. When Incentive Plans are based on such methods and purposes, without any desire to take advantage of workers in any way, there will generally be some form of co-operation.

Trade Union Opposition.

It should be particularly noted, however, that there may be an antagonistic attitude on the part of Trade Unions. This is largely a matter of principle, but there can be little doubt that some Incentive Systems are based upon the fact that the worker has much to gain and nothing to lose. Whilst this may be so, it is essential that any organization contemplating the installation of Incentive Plans should keep in mind that there may be quite serious opposition on the part of the trade unions, and success will not come unless the proposed system is one which appeals to, is largely sponsored by, and at least is endorsed by the employees affected. The opposition of the Trade Union is largely founded upon faults which have developed in the past and because practices carried out in the adoption of incentive schemes have not always been fair. There undoubtedly have been cases of sweating and exploitations and the *undue* penalising of the slower worker.

Base Rates.

The term "Base Rates" is used to indicate the retainer rates that are paid to secure willing service of employees, irrespective of any additional incentives for better or increased production. Base Rates represent the minimum rate of wages paid for work of a certain kind.

The Base Rate is the ordinary Day Rate or wage which is usually guaranteed to the worker in any incentive plan, whether he accomplishes a set task or not.

Emphasising the Base Rate.

It is always best to separate the employee's "incentive" wages from his "base" wages. If the total earnings of an employee are lumped together in the same pay-envelope or merged into a single pay cheque, there is danger that the value of his "incentive" earnings as a stimulus to increased interest and co-operation will gradually diminish. It is often a wise plan to use two distinct pay-envelopes—one, containing the regular wages calculated according to the base rate; the other containing the "incentive" earnings.

Job Classification.

Before Base Rates can be intelligently established, it is necessary to classify the various types of jobs. This classification is of two kinds:—

(a) By trade or occupation.

(b) By grades within each of the above.

Classification will often disclose many conditions of unfairness and incompatibility of compensation. It is then necessary to investigate the factors that will affect the minimum and maximum wages.

Information on the following factors should be secured:—

(a) Prevailing rates in the occupations and classification of jobs within each occupation.

(b) Arbitration Court Awards and trade union scales.

(c) Labour supply available.

(d) Standard of mental and physical requirements (high, normal or low) for each subdivision of each occupation.

(e) Degree of experience and skill required in the particular business as compared with other businesses in the community.

(f) Standards of living represented in each occupation.

(g) Production costs and profits, these in turn also depending upon the efficiency of management.

Each of the above factors needs to be considered in turn, in its bearing on the hourly base rate and range, from minimum to maximum, that should apply to each grade and class of job in each trade or occupation. The rate should be sufficiently high to attract desirable workers, but need not be higher than prevailing rates for the same grade and class of work in a given locality—at all times, of course, subject to limitations imposed by Arbitration Court Awards.

Having determined what should be the minimum and maximum Base Rate for each occupation, it is then possible to proceed with the necessary investigations and standardizations preliminary to the establishment of Piece Rates or other incentive methods. When conditions are ready for the introduction of an Incentive Wage System, it remains to determine for each occupation what increment or advance over the hourly Base Rate should be offered as the inducement or incentive under the adopted wage plan which will spur the workers on to produce effective results. Experience has shown that unless it is possible for the average worker to add, without undue strain and merely by the exertion of conscientious application, a considerable percentage to his "base" earnings, he will not so exert himself. This increment varies according to the kind of work and wage system employed.

General Preliminaries.

Before undertaking the work of rate setting or the establishment of Job Time Standards, a certain amount of preliminary preparation is absolutely essential.

Standardization and control must be developed to such an extent as to make the incentive system run smoothly. This does not mean that these matters need to be developed to anything approaching the ideal or perfection. Most organisations have already in effect a certain amount of standardization and production control.

The starting point is the preparation of manufacturing programmes based on sales demands and records of previous years. Next comes the preparation of detailed planning of materials and operations. Plans of materials involve the establishment of stores records providing for allowances or reservations to orders, the maintenance of a perpetual Stores Inventory, and arrangements whereby materials are delivered at the proper time to the point of first operation. Plans of operations involve the routing of unworked and worked materials to the various operating centres in proper sequence. Scheduling involves the application of the time element to the operations with a view to determining the balance of work hours ahead which need to be performed at each production centre. Dispatching involves the removal of interferences with schedules and seeing that they are adjusted to meet changing conditions. It is modern practice to accompany the foregoing devices with inspection where needed, and with some scheme of predetermined cost estimates, department budgets and check-up of actual costs and results against predetermined costs and budgets.

It is not necessary to wait for perfection in the above matters before undertaking the installation of Incentive Wage Plans. The advantages to be secured through these Wage Plans are sometimes so great that it is folly to postpone their adoption to some period when the above systems and other conditions are expected to approach rather closely to the ideal. Conditions and methods are changing so rapidly that it is wise to make the best of such systems and installations as can be put into operation in a reasonable time. Indeed in smaller organisations excellent results can sometimes be achieved without waiting for the above, though there is in this way an added risk that the scheme may break down because of conditions arising outside the control of the worker, but preventing him from earning bonuses.

Specific Preliminaries.

Assuming that a fundamentally correct scheme of planning and production control is already in operation or has been laid out and put into effect as a necessary pre-requisite to installing the Wage Incentive Plan, there remain certain essential preliminaries definitely tied up with the matter of job time standards. There are—

(a) A study of variables.

(b) A certain amount of standardization.
(Both of the foregoing should be carried out before or at latest during the taking of time and motion studies).

(c) Time Study, embracing both Motion and Fatigue Studies.

(d) Determination of allowances, base rates, bonuses and increments.

(e) Demonstration and training.

Study of Variables.

In fixing standards for the performance of work, it is necessary to take into account those variables which will always be found—taking special care to determine whether they are avoidable or otherwise.

The most important variables are—

1. Differences in training, knowledge and general ability of workers.
2. Differences in surroundings, such as light, heat, inconvenience, etc.
3. Differences in equipment, tools and power transmission.
4. Differences in production methods on the same or similar work.
5. Various causes (very often of a physical nature) such as weather conditions in the case of construction work, etc.

A general study of variables should be made before undertaking Time and Motion Studies. Observation and recording of further variables must continue as they arise during the Time and Motion Studies. Other factors which should be taken into account are—

1. Amount of supervision necessary.
2. Responsibility involved.
3. Working conditions.
4. Value and importance of the work.
5. Length of time necessary to learn the work.
6. Difficulty of replacing labour.

Standardization.

Having investigated such matters as departmental layout of machinery, small tool equipment, motor belt drives, material handling, etc., such changes should be made as are immediately practical and not too expensive, with a view to the greatest possible uniformity of conditions and methods as they apply to the same or nearly similar jobs when done at different machines or in different departments. The way should always be left clear for further improvement and standardization by a protective statement to insure that the company is to be entitled to participation in the benefits brought about through improvements. The insertion of some statement similar to the following on all Bonus Schedules and if necessary, to accompany all bonus payments may accomplish this—

"The present rates have been arrived at by a combination of the Base Rate and a time allowance for doing the work.

The Base Rate is determined by business and industrial conditions.

The time allowance is determined by time observations under existing conditions at the production centre or machine to which they apply, and makes due allowance for all necessary and unavoidable loss or non-

Other Incentive Purposes.

It should be noted that an Incentive plan can be used for a number of other factors in addition to quantity of production, as, for example:—

1. Improvement in Quality of Product.
2. Avoidance of Material Waste.
3. Accident Prevention.
4. Regularity and Punctuality
5. Indirect Production.
6. Control of Maintenance and Repairs.
7. Supervision.

Essentials of a Good Financial Incentive Plan.

An Incentive plan is no cure-all. It is not even a primary remedy for industrial ills, but a phase of control effective only after such primary measures as correct processing, improved lay-out, job-standardization, and just rate-setting have been thoroughly carried out. Overdoing an incentive is as bad as underdoing it. Moreover, it is impossible to set up a single set of ideals for all plants. Special conditions have special requirements, and no plan should be expected to meet opposing conditions. In general, however, an Incentive plan for ordinary manufacturing departments should possess most of the following characteristics. It should be—

1. Fair to both employee and employer and should aim at contributing to the benefit of both. The reward should be positive and material, not negative nor unnecessarily punitive. Its operation should promote confidence.
2. High in task and in reward. The latter should, as it has been aptly put, "Reflect an employee's contribution to his company's success." Generous reward frequently encourages effort to meet high standards. (Taylor insisted that a successful plan should offer—
    - (a) Labourers, 30% to 60% more than class;
    - (b) Ordinary Mechanics, 70% to 80% more than class;
    - (c) Skill, brains, close application and bodily exercise, as high as 100% or more beyond class.

These percentages are too high for present day practice).

3. Sufficiently soundly based, not only to be fair and equitable, but also to guarantee against rate changes until operation method is changed. That is, the organisation should proceed on the understanding that earned reward will be paid.
4. Reasonably simple for employees to figure their own earnings, or at least to understand the method of working. The results should be available over as short a period as the accuracy of rates will permit.
5. Practical in shop procedure. Allowing for necessities of standardization, etc., the Incentive plan should harmonise with shop routine and methods.
6. Capable of use with other management controls, as well as shop procedure.
7. An aid to teamwork thus automatically assisting supervision in a practical manner.

Management should—

1. Obtain complete employee support of the plan, and to the greatest degree possible, co-operate with the Trade Unions wherever necessary.
2. Avoid any suggestion of a "Fatherly" attitude.
3. Give full support in matters of production, material and quality control, maintenance and non-financial incentives.
4. Avoid suspension or discontinuance of the plan because of difficult or changed trading conditions.
5. Pay bonuses promptly.

CHAPTER 7.

LABOUR — COST ACCOUNTING PROCEDURE.

Recording and Accounting for Labour mav embrace some or all of the following functions:—

1. Compiling hours worked by each man.
2. Compiling direct Labour Hours for each production-centre or machine.
3. Compiling direct Labour Hours for each Production Order.
4. Compiling cost of labour for each Production or Standing Order.
5. Calculating periodically the wages due to each man.

Three departments (or sections) are involved:—

1. Timekeeping department.
2. Wages or Payroll department.
3. Cost department.

Timekeeping.

In the small plant this may be done by the foreman. Sometimes it is carried out by the production section or by a separate department formed for the purpose. Timekeeping duties include:—

(a) Seeing that time worked by each employee is accurately recorded, showing the times of entering and leaving the premises.

(b) Ensuring that nobody registers for some other person.

(c) When dealing with job times, seeing that the correct time on each job is recorded and that all short time and overtime is shown.

Timekeeping records are usually effected by one of the following methods:—

(a) *Handwritten Records.*

Each department foreman may keep a Foreman's Time Book and each employee a Daily Time Card. The card is filled in each day with full details of the amount of time spent on each job, both ordinary and overtime. The total of the details on these cards should balance with the entries in the foreman's book, which would show the total hours worked each week. The Daily Time Cards would go to the Cost Office each day and the foreman's book would be used for compiling the wages each week.

(b) *Metal Checks.*

Each employee is given a metal check bearing a number, and these must be placed, each day, in a box set aside for the purpose. The boxes are generally divided to cater for a number of departments or sections, though separate boxes can be used. Provision of other boxes or apertures is made for late-comers. When a man arrives he takes his metal check from a board and puts it in a box. When he leaves he does the same thing, the box having been emptied in the meantime and the metal checks put back on the numbered board. When the metal checks are taken from the box, entries are made in a Time Book setting forth the hours worked by each employee.

These methods are rapidly becoming obsolete because of the availability of mechanical methods of recording.

(c) *Mechanical Methods.*

It is impossible to cover nearly all of the methods available for machine recording and checking of times. The usual type is the machine with the clock dial. This may print the "in" and "out" times on Time Cards; it may print the information on specially ruled paper inside the machine, or it may automatically record times against employees' signatures. (See Figure No. 37.) Very often two card racks will be found with the machine, one on each side of it. When the Time Cards have been prepared, they are placed in the rack nearest the door or gate through which the employee will enter. Each employee then takes the card bearing his name and number, puts it in the machine and pulls a handle or operates a lever so that the machine prints the time upon an allotted space. He then places the card in the other rack provided for the purpose. Those cards not taken from the first rack denote the absentees. When the employee stops work and leaves, a similar process is followed, but the cards are taken from the "In" rack and placed in the "Out." This would be done at lunch time as well as in the evening. Often an officer of the organisation is stationed at the clock to prevent "ringing the clock." Sometimes racks are cleared at a certain time to make late employees apply to the office for their cards.

FIGURE No. 37.

DAILY AND WEEKLY TIME CARD.

Name .... Clock No.................................
Week Ended.............................
Department .... Workman's Grade.......................

Day	Morning		Afternoon		No of Ordinary Hours	Overtime		No. of Overtime Hours	Total Hours
	In	Out	In	Out		In	Out		
Friday									
Saturday									
Sunday									
Monday									
Tuesday									
Wednesday									
Thursday									

Ordinary Time Hours @ £
Overtime Hours @ £
Received Payment of Wages as above Total Wages £

Checked by

FIGURE No. 38.

JOB TIME CARD.

Name
Department

Clock No.
Date

Start	Finish	Ordinary Time		Overtime		Amount	Job or Standing Order No.	Machine No.	Operation No.	No. of Components Completed	No. Spoiled	Remarks
		Time	Rate	Time	Rate							

Total Time
Total Clock Time

Certified

Foreman

Where Time Cards are used only to record commencement and finishing times of employees, some other method must be used to record the times spent on each job, where this information is necessary to arrive at correct costs. (See Figure No. 38.) Sometimes this is done by means of handwritten records kept by the men and initialled as being correct by the foreman. In other organisations, the foreman keeps the necessary records and passes these through to the Cost Office. In both of the foregoing cases the total of the job times should equal the total hours worked or the discrepancy explained. It is commonly found, however, that the Time Cards mentioned above are used to record both total hours worked and also the various job times. Combined Daily and Job Time Cards are thus used, a space being shown for total hours worked and further space for entering full details of jobs carried out. As each job is finished the clock is used for printing the time on the ticket.

A further method in use is to have Daily Time Cards and also Job Cards for the various work to be done, each particular job having its own special card. Where this method is in operation, work planning must be in operation to such an extent that Job Cards for work ahead must be available. The usual method is to have three racks—one to hold the jobs ahead or waiting, another to hold cards for the jobs in operation at the time, and a third to cover completed jobs. Productive routine frequently reaches its highest efficiency point under this scheme. Such a card would probably contain the following particulars:—

1. Workman's name and number.
2. Time work was commenced.
3. Time work was completed.
4. Elapsed time on the job.
5. Rate of wages applicable.
6. Total of wages due.
7. Operation (nature of work).
8. Number of machines used on the job.
9. Production or standing order number.
10. Customer's name (where special order).
11. Signature of clerk issuing card.
12. Signature of departmental foreman.

There are certain types of elapsed and cumulative elapsed time recorders on the market. These automatically calculate the elapsed time between any two printings, and with the cumulative elapsed time machine it is possible to arrange for the machine to calculate the whole of the time spent upon a particular job. This naturally prevents errors and promotes efficiency, because manual calculations of elapsed times are usually found tedious and sometimes slow.

Where separate cards are used for each job, at the close of each day, each worker's cards should account for:—

1. His total hours for the day.
2. Total number of direct hours worked on each machine.
3. Total labour cost chargeable to each order (either production order or standing order).
4. Total number of hours worked on each production order.

It should be noted that one of the most important divisions that must be made in connection with times is whether the time is direct or indirect. In the routine of accounting for labour, the Time Tickets would be sent daily to the cost or accounting department. There they are sorted and re-sorted so that the necessary information can be most expeditiously abstracted. The first sorting separates the Direct Labour Tickets from the Indirect. The former are used for charging to cost sheets and the latter to the standing orders.

Wages Sheets or Payroll.

Wages Sheets or Payroll should provide space for the following:—

1. Names and numbers of employees.
2. Hours worked each day of the period.
3. Total hours for the week.
4. Rates per hour.
5. Gross earnings (total hours times rate applicable)
6. Deductions from gross earnings.
7. Net earnings due employees.
8. Classification of employment in each case.
9. Bonuses due.
10. Total for department or for the whole factory.

All relevant particulars are entered from the various cards and the necessary deductions made. (See Figure No. 39.) The Wages Sheets can be completed by being handwritten (very small businesses), typewritten, or printed by mechanical means (as is frequently done in large businesses). The use of machines has effected great savings in clerical labour.

No attempt will be made to outline the different features of various machines used in connection with Payrolls (amongst other things), as application to the various accounting system sales organisations will obtain expert information, including latest ideas in these matters.

Payment of Wages.

Wages can be paid by one of a number of methods—

1. The sum can be personally handed to each man by the pay clerk, without any actual receipt.
2. Each employee can sign the Wages Book, which acts as a receipt.
3. The signature can be obtained in a special book, one page of which can be allotted to each man, to cover such a period as, for example, six months.
4. The Daily Time Card can be so ruled as to allow a space for the signature, particularly where such cards provide for the full working week. This method can be used to safeguard against collusion and fraud.

Much could be written detailing exact methods of paying employees, but most organisations have developed, over a period of years, a method which suits their individual circumstances and seemingly overcomes their peculiar difficulties. Undoubtedly loose systems promote fraud and a

FIGURE No. 39.

PAYROLL SUMMARY

Payroll for period ended

			Earnings												Allocation			Deductions				
			Ordinary			Overtime				Piecework				Total Gross								
								Amount				Amount •										
Dept.	No.	Name	Hrs.	Rate	Amt.	Hrs.	Rate	Ord	O T	Pieces	Rate	Earned	Bonus or Penalty	Earnings	M or F.	Direct	In-Direct	Inc. Tax	Superan	War Loan	Total	Nett Earnings
													adjustment to award rate									
No. 1					400			66	34			80	20	600		566	34	15	10	3	28	572
No. 2					250							45	5	300		300		7	4	2	13	287
No. 3					80							20	—	100		100		2	1	1	4	96
In-direct					500									500			500	12	9	3	24	476
Total					1230			66	34			145	25	1500		966	534	36	24	9	69	1431
														1000 500	M F							

See Journal Entries.

JOURNAL ENTRIES

Payroll A/c Dr.	£1431	
To Cash		£1431

Pay cheque posted direct from General Cash Pmts Book.

....

Payroll A/c Dr.	£69	
To Income Tax		£36
„ Superan. A/c		24
„ War Loan		9

Adjustment of deductions.

NOTE.—Where Standard Costs are in use provision will require to be made for extension of Departmental Hours at Standard Rates and the Disclosure of Variations.

strong system of internal check is essential as a safeguard. The fundamental precautions are—

1. That employees are always or at least periodically (and without notice) identified when receiving their wages.
2. That the person or persons making up the Wages Sheets do not carry out the actual paying functions.
3. That a change of paying personnel take place at intervals if this is at all practicable.

Obviously, in smaller organisations, where each man is known personally such precautions may not be necessary.

Cost Routine.

The following steps in this routine should be noted—

Direct Labour.

1. Enter the hours on the Wages Sheet or Payroll.
2. Enter the hours on a Time Summary for the period.
3. Charge the Cost Sheets with direct labour cost.
4. Record on the appropriate Cost Sheets the hours spent on the job.

Indirect Labour.

1. Enter the hours on the Wages Sheet or Payroll.
2. Charge Standing Orders with the indirect cost.

The Direct Labour Time Tickets for each day should be sorted according to employees' names and the total hours for each worker determined and entered in the correct column of the payroll—if necessary departmentally. (See Figure No. 40). If the number of hours of direct labour spent on the jobs is desired, a column for "hours" should be provided. When this is done, a summary of job times would agree with the total hours shown by the Direct Labour Time Tickets for each day of the period. (See Figure

FIGURE No. 40.

DEPARTMENTAL LABOUR SUMMARY.

Month	Day	Gross Earnings	Charged to W.I.P.			Indirect Wages
			Dept. 1	Dept. 2	Dept. 3	
Mar.	1					
	2					
	3					
	4					
	&c.					
	28	(Reconcil	e here with	Cash Paym	ents per	
	29		Pa	yroll)		
	30					
	31					

FIGURE No. 41.

DAILY SUMMARY OF JOB TIMES.

Date								Department				
Clock No.	Name	Amount	Job Orders								Standing Orders	
			No. 246	254	255	256	260	261	262	263	No.	Amount

FIGURE No. 42.

MACHINE TIME SUMMARY.

From.. To ....

No. of Machine	Type of Machine	Department	Location	Hours Worked	Total Capacity Hours	Remarks

No. 41). It might, however, be desirable to know the number of hours spent on each job in each department. Each Direct Labour Time Ticket would show the department, and the tickets would be sorted according to departments and would be entered on the Cost Sheet accordingly. Where it is desired to compile the total hours spent upon each machine, a Machine Time Summary would be prepared. (See Figure No. 42). This would provide a column for each machine and a line for each day of the period. Each day the Time Tickets would be sorted according to machine numbers. The total hours for each machine would thus be determined, and the total would be entered in the Summary. This would then also show the total for all machines. If this amount can be compared with the number of machine hours which should have been covered during the week, it is possible to determine the total amount of idle time or overtime on the machines for the period.

e.g., Actual time Machine 123. 212 hours. Normal time, 195 hours.
„ „ „ 124. 106 „ „ „ 122 „

Machine 123 would show 17 hours' overtime and No. 124 16 hours' idle time. The Machine Time Summary can therefore be used as an efficiency report. In manufacturing organisations where most operations are performed on machines, the Machine Summary is often used as the "pulse" of operations. It shows day by day which machines are being used. An idle machine may mean lack of orders or improper routine. (See Figure No. 43).

FIGURE No. 43.

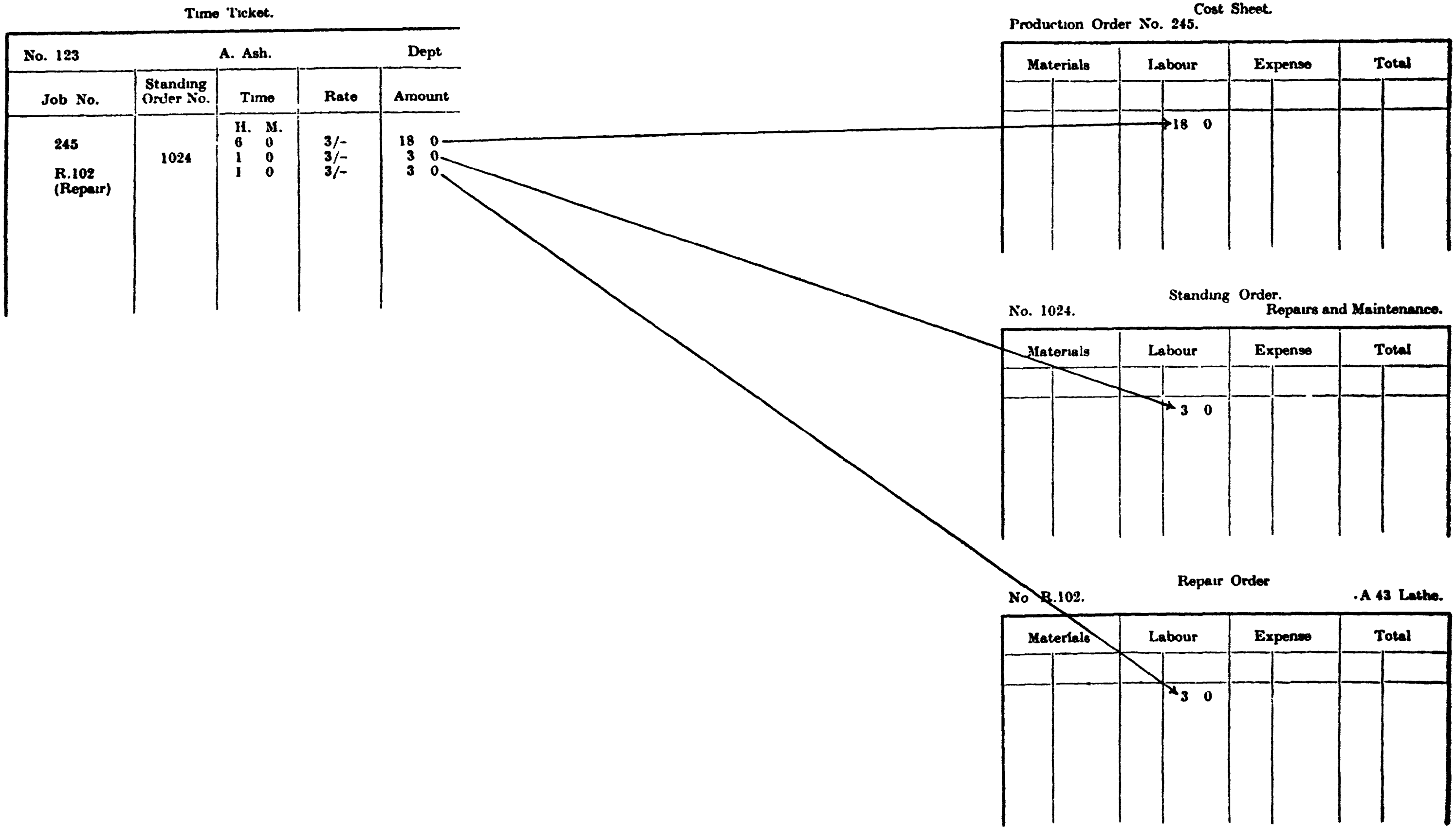
REPORT OF IDLE MACHINE TIME.

Week Ending..

Dept.	Machine Number	Type of Machine	Capacity Hours	Actual Hours	Idle Time	Overhead Rate	Amount	Reasons
							£ s. d.	

In order to charge the various Cost Sheets, the Labour Time Tickets are sorted according to the jobs to be charged and the total labour cost chargeable to each job is determined. The amount is then entered upon the appropriate Cost Sheet. (See Figure No. 44).

FIGURE No. 44.
LABOUR COST ENTRIES.



Time Ticket.

No. 123		A. Ash.		Dept
Job No.	Standing Order No.	Time	Rate	Amount
		H. M.		
245		6 0	3/-	18 0
	1024	1 0	3/-	3 0
R.102 (Repair)		1 0	3/-	3 0

Cost Sheet.
Production Order No. 245.

Materials	Labour	Expense	Total
	18 0		

Standing Order.
No. 1024. Repairs and Maintenance.

Materials	Labour	Expense	Total
	3 0		

Repair Order
No R.102. A 43 Lathe.

Materials	Labour	Expense	Total
	3 0		

In the case of Indirect Labour Charges, the procedure is:—

1. Sort the tickets according to employees' names; determine the total hours for each employee; enter the total on the Payroll in the proper day column.
2. Sort the tickets according to standing orders to be charged, determine the total charge to each, and record the charge in the proper account.

In the case of Labour Charges on Betterment or Plant Orders—

1. Sort the tickets according to workers, find the total number of hours for each worker, and record it opposite his name on the payroll. Total wages are charged to the Betterment Control Account
2. Re-arrange the Time Tickets according to order numbers, determine the total labour cost against each number and charge the appropriate Betterment Cost Sheet.

When the Payroll is completed the necessary book entries would be (assuming the following information)—

Direct Labour Cost	£300
Indirect Labour Cost	100
Deduction for Workers' Compensation Insurance	25
Deduction for Taxes	40
Deductions for Hospital Contributions	5
Deductions for Loan Payments	30
Amount Due Workers	300

Labour in Process	Dr.	£300		
Factory Expense	Dr.	100		
To Insurance Due			Cr.	£25
Taxes Due			Cr.	40
Hospital Contributions			Cr.	5
War Loan Payments			Cr.	30
Employees			Cr.	300

Briefly, the cost routine to cover accounting for labour can be summarised as under—

1. To enter hours worked on the payroll—

   Sort the Direct Labour Time Tickets for each day according to employee's name determine the total hours for each worker and enter these totals in the proper columns.

2. To enter hours worked on a "Machine Summary"—

   Sort the Time Tickets according to machine numbers; determine the total hours for each machine and enter the total in the Summary.

3. To charge the Cost Sheets affected—

   Arrange the Direct Labour Time Tickets according to jobs to be charged, determine the total labour cost chargeable to each job and enter the amount for each job on its Cost Sheet.

4. To enter machine hours worked on individual Production Orders—

   Arrange the tickets for each job according to machine numbers. Ascertain the total hours for each machine and record these totals on the appropriate Cost Sheet.

5. To enter Indirect Labour—
    - (a) Sort the tickets according to employees' names; determine the total hours for each employee, enter the totals on the Payroll in the proper day column.
    - (b) Sort the tickets according to Standing Orders to be charged, determine the total charge to each and record the charge in the correct account.

Internal Checks Over Records.

The value of the following internal checks should be noted—

1. Direct Labour Hours entered upon Cost Sheets should equal number entered in Payroll.
2 Direct Labour Cost entered upon Cost Sheets should equal amount shown in Payroll.
3. Indirect Labour Hours and cost entered in Standing Orders should equal amount shown in Payroll.
4. Labour in Process account should tie up with the Labour Charges on the Cost sheets.
5. Labour Charges to Factory Expense should agree with the total shown for Labour Charge in the various Standing Orders. (See Figure No. 49).

The accounting entries necessary to cover the various wages transactions are shown in Figure No. 45. The routine of accounting procedure is shown in Figure No. 46.

Transfer Between Departments.

Where men are transferred from one department to another, a transfer form should be issued immediately, generally by the timekeeper as the result of a request from the foreman of the department transferring the labour. Reasons for the change and its authorisation should be shown and a copy of the transfer should be sent to the Cost Office.

Departmentalisation of Wages Records.

This usually promotes no difficulty provided that due notice is taken of the necessity for inter-departmental transfers. Furthermore, it should be understood that the direct productive labour of one department may be factory expense of another department, as, for example, where the machine shop carries out repair work for the foundry under a Repair Order.

Avoidance of Lost Time.

An inspection of Labour Records will frequently show the amount of lost time and give information which should lead to its reduction in the future. Productive employees used on repair work, men idle because of plant break-downs—all can be shown plainly through correct Job Time Card analysis.

FIGURE No 45

GENERAL AND COST LEDGER ENTRIES.

	Original Financial Record	Entry in General Ledger	Original Cost Record	Entry in Cost Records
Wages Due at end of Period	Period Wages Summary (Voucher Register)	Wages Cr. Accrued Wages	Time Cards and entries on Wages Summary	Debit Entry in Cost Sheets of Job Orders, Standing Orders and Plant or Repair Orders.
Payment of Wages	Cash Book	Accrued Wages Cr. Cash	Nil	Nil
Distribution of Wages Due at end of Period	Period Wages Summary (Journal)	Dr. Work in Process—Labor Dr. Work in Process—Manufacturing Expense Cr. Wages	Nil	Nil
Spoiled Work — Labour Costs	Spoiled Work Summary (Journal)	Dr. Manufacturing Expense Cr. Work in Process	Spoiled Work Reports	Debit Standing Order for Spoiled Work. Credit Labour Cost Section of Production Order.

FIGURE NO. 46.

LABOUR CONTROL—ROUTINE ACCOUNTING PROCEDURE.

Upon engagement, worker is assigned a clock number and then proceeds to record his time upon a Clock Time Card.

CLOCK TIME CARD

Name : A. Adam. No. 201
Week Ended January 8th 19......

Date	In	Out	In	Out	Total Remarks
2	7.30	12.0	1.0	5.0	8½ hrs.
3					
4					
5					
					Signed................ .
					46½ hrs.

For the various Jobs he is issued with a Job Time Card.

The various times are checked and certified to by the foreman who subsequently forwards his card to the Cost Office which checks the clock time card with the job time card.

JOB TIME CARD.

Name : A. Adam. No. 333

Production Order No	Drawings No.	Time Comm.	Time Fin.	Elapsed Time	Rate	Amount
101	A42/3	7.30	11.30	4 hrs.	3/-	12.0

The various Clock Time Cards are summarised by the Wages Sections and entered in the Payroll Summary.

The totals of the Payroll Summary are checked with the totals of the Job Time Cards and should balance.

PAYROLL SUMMARY.

Week ended.................... Dept.........................

No.	Dept.	Name	2	3	4	5	6	7	Total	Rate	Amount
333	M/Shop	A. Adam	8½						46½	3/-	£6 19 6
											£2465 8 6

The items shown on the Job Time Card are then posted by the Cost Section to the Job Cost Sheet.

Amounts for Expense would be posted to Standing Orders and for Repairs or Betterments to Repairs or Betterments Cost Sheets.

COST SHEET.

Job No. 101——50 Inside Elbows No. ....

Commenced.................. A/42/3. Date............

Finished ....

Stores Requ. No.	Materials Cost	Job Time Card	Wages Cost	Dept.	Expense Summary	Expense Cost

The amount of the payroll summary is here journalised by the preparation of a voucher and the necessary entry in the Voucher Register.

Subsequently the wages cheque is drawn, the pay envelopes prepared and the men paid according to the paying procedure.

VOUCHER REGISTER.

Month of.......................... Debits 194.........

Date	Description	Vouch. No.	Accounts Payable	Factory Expense	Work in Process
Jany. 8	Payroll	456	£2,465 8 6	£325 18 6	£2,139 10 0

The various amounts are then posted to the respective accounts in the Ledger as, per example —Work in Process A/c.

WORK IN PROCESS A/c.

	Debit	Credit
194......		
Jany. 8	To Payroll £2139 10 0	

CHAPTER 8.

FACTORY EXPENSE — DISTRIBUTION BASES.

Factory Expense.

This is the third of the three elements of expense, and usually provides problems of a somewhat different nature from the other two—Materials and Labour. It is the total of all expense (other than the Direct Material and Direct Labour Cost) which is incurred in the possession and operation of the factory. It does not include such expenses as are incurred in selling the product or in managing the general affairs of the organisation. It should be noted, however, that it does include the direct cost of managing the factory where this is definitely segregated from general management.

Possession of the factory calls for such expenses as Rates and Taxes, Insurance and Depreciation, whilst operation of the factory necessitates the services of Factory Management, Supervision, Storekeeping, etc., and also incurs expense for Power, Light and Heat. Typical factory expenses would therefore be—Power Expense, Lighting and Heating, Plant and Building Insurance, Repairs and Renewals, Rates (as applied to the factory), Factory Office Expenses, etc.

There is a wide variety of other names which are sometimes used in place of Factory Expense, e.g., Manufacturing Expense, Factory Overhead, Factory Burden, Factory Loading, Factory Oncost. It seems reasonable to suggest that the term Factory Expense covers all that is required, is simple and without obvious objections. Some of the other terms suggest meanings which should be avoided.

Elements of Factory Expense.

The various elements entering into the total of factory expense are—

(a) *Indirect Materials.*

Goods which are used for the benefit of production as a whole and not for some particular product. The material does not form an integral part of the product—e.g., lubricants, waste, sandpaper. At times it is necessary to include under this heading materials used in connection with certain products, but in such small quantities that it is hardly practicable to charge these direct to the product—e.g., glue in a furniture factory.

(b) *Indirect Labour.*

Labour which cannot be identified with particular lots of products, but is of general application. Supervisory labour is nearly always of this kind, and other examples are—wages of cleaners, timekeepers, storekeepers, receiving clerks, etc. A proportion of salaries would also be indirect labour, though frequently this is kept separate from other items of Factory Expense.

(c) *Indirect Expense.*

This would include other costs incurred for the benefit of the factory as a whole or part of it, but not attributable to any particular products, e.g., Power, Rent, Insurance, Depreciation, Repairs.

Sources of Factory Expense.

(a) Indirect Materials originate in Material Requisitions. When these are classified and totalled, amounts applicable to various types of expense find their way into Standing Orders, which take the place of Expense Ledger Accounts. At the end of each month (or some lesser period) the total of these items is charged to the Factory Expense Control Account.

(b) Indirect Labour is obtained in the first place from the Time Cards, which are later entered into the Payroll. This expense finds its way, firstly in individual items to the various Standing Orders, and at the end of the month the total is debited to the Factory Expense Control Account.

(c) Indirect Expense can come from several sources—e.g., in the case of cash outlays, the entry may come direct from the Cash Book, or the entry may be journalised and come from the Factory Journal or Voucher Register. (Various terms are frequently applied to account books of this kind). Entries of such items as Depreciation, etc., would also be entered in the Factory Journal. At the end of the month the total of Factory Expense would be posted to the debit of the Factory Expense Control Account, the individual items having already been posted to the various Standing Orders affected. It should be noted that some expense items, such as Power, Lighting, Heating, Rent, etc., may not be solely applicable to Factory Expense, but should be apportioned between Factory Expense, Selling Expense and Administration Expense.

An example of Standing Orders of a type usually found in most organisations will be found in Figure No. 10.

Allocation of Factory Expense.

The ultimate aim of the accumulation and recording of this expense is to apply it to the products it affects. This may be done in a number of ways and by various methods but three main considerations involved should be noted—

(a) It may be applied to departments and kept in departments, the totals of departmental expense being added to arrive at final cost.

(b) It may first be applied to departments and the departmental accounts then used to distribute the various expenses to the different products.

(c) The expense may be applied direct from Standing Orders to the products affected.

There are also three factors involved in choosing the best method to be applied to each particular business—

(a) The type of manufacturing processes and products involved.

(b) The degree of accuracy required in cost computations.

(c) The amount of clerical cost involved.

It is now proposed to consider the methods that can be used to apportion expense.

Unit Costs Through Departments.

This is generally the simplest method of cost finding, and it is usually desirable to departmentalise manufacturing expense for the following reasons—

1. To determine the cost of Service Departments.

2. To enable Departmental Rates (which may differ considerably between departments) to be arrived at for application to products.
3. To facilitate the measurement of *departmental* idle capacity.

Departmentalisation involves the allocation of functional responsibility after due notice has been taken of the factory lay-out, the manufacturing routine, procedure and operations and the practicability of an accurate division of expense. Where departmentalisation is desirable, the Raw Materials and the Labour Costs will already have been charged to departments, and the total of Factory Expense incurred will be broken down into departments and debited to such. It should be noted that Service Departments are, in such a case, debited with their share of expense as well as the actual Producing Departments. The total charges debited to the Service Departments would then be finally distributed to the Producing Departments—e.g.—

Factory Expenses Incurred—

Rent	£20
Rates	10
Depreciation	100
Insurance	10
Light	10
Power	50
	£200

Could be apportioned thus—

Service Department "A"	£25
Service Department "B"	20
Production Department "C"	50
Production Department "D"	40
Production Department "E"	65
	£200

The expense of the Service Departments would then be distributed to the Production Departments—e.g.—

Production Department "C" Dr. £5
" " "D" Dr. 5
" " "E" Dr. 15
To Service Department "A" Cr. £25
Production Department "C" Dr. £5
" " "D" Dr. 10
" " "E" Dr. 5
To Service Department "B" Cr. £20

This would mean that the total expense which ultimately found its way to the Production Department would be—

Dept.	Originally	From Service "A"	From Service "B"	Total
"C"	£50	£5	£5	£60
"D"	40	5	10	55
"E"	65	15	5	85
				£200

The guiding principle in determining the amount of each Service Department Expense which should be charged to each Producing Department would be the extent to which each Producing Department had benefited from the service given by each Service Department. Sometimes this can be arrived at very accurately, and at others it must be estimated as closely as possible and left at that. Assuming that ten units had been processed in the above case, the unit cost would be—

Department "C" — Grinding	£6	0	0
„ "D" — Milling	5	10	0
„ "E" — Polishing	8	10	0
	£20	0	0

The illustration has purposely been kept in simplest terms, but it is indicative of the method applicable in similar cases. The Producing Department Costs would also include the appropriations covering Materials and Labour. This type of distribution (sometimes referred to as the Unit Cost Method) can be used where there is only one product being turned out—e.g.—

Total Factory Expense = £4,500.

Tonnage Produced.		Departmental Factory Expense.	
Department 1.	10,000 tons	$\frac{10,000}{45,000} \times$ £4,500 =	£1,000
„ 2.	15,000 „	$\frac{15,000}{45.000} \times$ £4,500 =	£1,500
„ 3.	12,000 „	$\frac{12,000}{45.000} \times$ £4,500 =	£1,200
„ 4.	8,000 „	$\frac{8,000}{45,000} \times$ £4,500 =	£ 800
	45,000 tons.		£4,500

Product Costs Through Departments.

In the foregoing example, it has been assumed that there is but one product being processed, and the final unit is therefore all that is necessary. The position is more complicated, however, where there are a number of products involved. For example, there may be four products made, all of which go through some operations in each Production Department. In such a case the totals of the Departmental Accounts, after Service Departments have been distributed to the Production Departments, would have to be further analysed to enable appropriations to be made to the various products manufactured. Naturally the amounts thus apportioned would have to be in line with the service rendered by each Production Department to each product. In the example shown on the previous page, therefore, we could have this further step—

		Product 1	Product 2	Product 3	Product 4	Total
Department	"C"	20	10	15	15	60
„	"D"	10	15	20	10	55
„	"E"	30	10	10	35	85
	Totals	£60	£35	£45	£60	£200

PRODUCT COSTS BY DIRECT APPLICATION.

Factory Expense can be charged to the various cost sheets by one of a number of methods, all of which are based upon the use of rates or proportions common to all jobs. These Factory Expense rates may be based upon Actual Expense or Normal Expense. Factory Expense rates based on actual figures naturally cannot be calculated until the close of the month, but those based on normal figures are generally calculated at the beginning of the month or period. This latter method is considered later. The following are the most important methods of distribution—

1. Direct Labour Hour Rate Method.

One of the methods which can be used is the Direct Labour Hour Rate method, the formula for the use of this method being—

$$\text{Direct Labour Hour Rate} = \frac{\text{Factory Expense for the Month.}}{\text{Direct Labour Hours for the Month.}}$$

Factory Expense would then be applied to the jobs for the month according to the formula—

Factory Expense for Job = Direct Labour Hours on job, multiplied by Direct Labour Hour Expense Rate.

e.g.,	Factory Expense for the Month	£500
	Direct Labour Hours for the Month	5,000
	Direct Labour Hours for Job No. 121	60

The Direct Labour Hour Rate is—

$$\frac{\text{Factory Expense}}{\text{Labour Hours}} = \frac{\pounds 500}{5{,}000 \text{ hours}} = 2/\text{- per hour.}$$

Factory Expense applied to Job No. 121 would be—

60 hours at 2/- per hour = £6 0 0

It will be readily gathered that the amount of production would have the greatest effect upon the amount of the rate. For example, supposing that production is very slack, but that Factory Expense does not change. (There would undoubtedly be some decrease in the total Factory Expense in such a case, but it would not fall nearly proportionately to the fall in production, because so many items making up the total Factory Expense are fixed in amount, e.g., Rent, Taxes, Rates, Insurance, etc.).

Factory Expense for the Month	£500
Direct Labour Hours for the Month	2,500 hours
Direct Labour Hours for Job 121	60 hours

The Direct Labour Hours Rate is—

$$\frac{\text{Factory Expense}}{\text{Labour Hours}} = \frac{£500}{2{,}500} = \text{4/- per hour.}$$

On Job No. 121 it would be—

60 hours at 4/- per hour = £12 0 0.

It is this condition that the use of a Normal Capacity Basis seeks to overcome. This is examined in a later chapter.

2. Direct Labour Cost Method.

Under certain conditions Factory Expense may be applied on the basis of Direct Labour Cost. This method generally requires less clerical labour and bookkeeping than the previous one, because it is not necessary to show any labour hours on the Cost Sheets. The Factory Expense is applied to the Labour Cost shown on such Cost Sheets—e.g.

$$\text{Direct Labour Cost Rate} = \frac{\text{Factory Expense for the Month.}}{\text{Direct Labour Cost for the Month.}}$$

Factory Expense for the Month	£500
Direct Labour Cost for the Month	£4,000
Direct Labour Cost on Job No. 121	£40

$$\text{Direct Labour Cost Rate} = \frac{£500}{£4{,}000} = \text{2/6 per £ of Direct Labour.}$$

Applied to the Cost Sheet of Job No. 121 = £40 @ 2/6 = £5 0 0

3. Material Cost Method.

The ratio which Factory Expense bears to Materials Used is the basis adopted in this case. This can be applied to materials used in a product or a department, e.g.—

Materials Used	£5,000
Factory Expense	£4,000

Factory Expense therefore represents 80% of the value of materials. If, therefore, in Department 2 the materials used cost £1,000, an amount of £800 would be distributed to that Department to cover Factory Expense. If Job No. 121 showed Materials Used as amounting to £5, Factory Expense totalling £4 would be applicable to this job.

4. Prime Cost Method.

The basis adopted in this method is the Prime Cost, i.e., the total of Materials and Labour. If Factory Expense totalled £4,000, Materials Used £5,000, and Wages £3,000, the Factory Expense would equal 50% of the Prime Cost. The amount to be added to each job would therefore be 50% of the total value of Materials and Labour expended on the job.

CONSIDERATION OF THE FOREGOING METHODS.

Let us suppose that a manufacturer ascertains his total monthly costs as under—

Materials	£4,000
Labour	2,000
Factory Expense	2,000

He also notes that in Products "A" and "B," which he manufactures, the following results are shown—

	Product "A"		Product "B"	
	s.	d.	s.	d.
Materials	12	0	4	0
Labour	8	0	8	0

If he distributes on the basis of *Materials Used,* his results will be—

	Product "A"			Product "B"		
		s.	d.		s.	d.
Materials		12	0		4	0
Labour		8	0		8	0
Factory Expense		6	0		2	0
Total Factory Cost	£1	6	0		14	0

On the basis of *Labour Cost,* the figures would be—

	Product "A"			Product "B"		
		s.	d.		s.	d.
Materials		12	0		4	0
Labour		8	0		8	0
Factory Expense		8	0		8	0
Total Factory Cost	£1	8	0	£1	0	0

On the basis of *Prime Cost,* the results would show—

	Product "A"			Product "B"		
		s.	d.		s.	d.
Materials		12	0		4	0
Labour		8	0		8	0
Factory Expense		6	8		4	0
Total Factory Cost	£1	6	8		16	0

Assume that Product "A" was made largely as the result of hand labour and required in all 4 hours at 2/- per hour, whilst Product "B" required skilled labour for 2 hours at 4/- per hour. Assume also that the total Direct Labour Hours for manufacture totalled 12,000 hours, then on a *Direct Labour Hours'* basis the results would be—

	Product "A"			Product "B"		
		s.	d.		s.	d.
Materials		12	0		4	0
Labour		8	0		8	0
Factory Expense		13	4		6	8
Total Factory Cost	£1	13	4		18	8

It should be noted that every one of the foregoing methods can enable the full £2,000 of Factory Expense to be appropriated to the various products. Arithmetically an authentic balance of accounts is obtained. But the problem is more than one of arithmetic. Let us make one further assumption—that the manufacturer, thinking that a percentage on Direct Materials was the best method, had adopted this, and his selling prices for the two articles were—

Product "A"	£1 12 0
Product "B"	18 6

If his contention was correct, the two products would show him Gross Profits of—

Product "A"	6/-
Product "B"	4/6

If, however, he is in error, and the Labour Cost Basis was actually the best, the result would be—

Product "A"	4/-	Profit
Product "B"	1/6	Loss

On a Prime Cost basis, the result would be—

Product "A"	5/4	Profit
Product "B"	2/6	Profit

On Direct Labour Hours, the result would be—

Product "A"	1/4	Loss
Product "B"	2d.	Loss.

These variances, of course, would have an effect upon the costs and results of other products. A comparison of two jobs is also shown in Figure No. 47. From this it will be seen that although four times the labour expended on Job "A" has been incurred by Job "B," this is not reflected in the charge made to the jobs for Factory Expense.

Advantages and Disadvantages of the Foregoing Methods.

The Direct Materials Cost, the Direct Labour Cost and the Prime Cost methods have the virtue of simplicity. They are easily arrived at and predetermined where necessary. Calculations are generally not involved, the records required are few, and clerical labour necessary is economical. From the foregoing illustrations, however, it will be seen that what is gained in simplicity may well be lost in accuracy. The value of materials is often

FIGURE No. 47.

DISTRIBUTION OF EXPENSE — PRIME COST BASIS.

JOB "A"		JOB "B"	
Direct Materials	£150	Direct Materials	£20
Direct Wages (100 hours @ 2/- per hr.)	10	Direct Wages (400 hours @ 2/- per hour)	40
Prime Cost	£160	Prime Cost	£60
Factory Expense (50% on Prime Cost)	80	Factory Expense (50% on Prime Cost)	30
Factory Cost	£240	*Factory Cost*	£90

too uncertain a basis, e.g., a pharmaceutical chemist may deal in two materials—one worth 10/- per ounce, and another 6d. per lb. The labour involved when either of these two products were used may be approximately the same. In the case of Direct Wages, no distinction is made when some of the workers use expensive machines and others are engaged on hand work. Furthermore, wages of workers doing the same kind of work vary, and the Expense Charge would therefore often be incorrect. Again no discrimination is shown between fast and slow workers. Similar objections can be urged against the Prime Cost method. It could only be acceptable if the objections to the materials cost method neutralised those of the Direct Wages Cost method. Unfortunately there is seldom any fixed relationship between Expense and Prime Cost, except where the two elements of Material and Labour remain fairly constant. Jobs and processes usually involve the use of different types and values of machinery or labour equipment, and the charge for these cannot be assumed to be proportionate to Prime Cost.

The use of Direct Labour Hours represents a step forward, inasmuch as it seeks to base apportionments on probably the most important element in the incurring of expense—time. It avoids the fluctuations due to changes in labour rates or earnings or in the prices of materials, and often gives very satisfactory results in accurate costing. Its main disadvantage is to be found in the additional clerical records necessary, viz.—

1. The number of Direct Labour Hours spent on each Job or Production order.
2. The total number of Direct Labour Hours worked by the workers in each department.

It should be noted however that if the productive departments of a factory vary widely in the nature of equipment and skill of operators, no average expense per productive hour will be indicative of the actual Factory Expense applicable to any department.

When the Foregoing Methods are Applicable.

Despite the disadvantages outlined, there are certain conditions under which one of the foregoing methods may be quite acceptable, particularly in view of the great advantage which simplicity and economy can give.

1. Percentage on Materials method can often be used to advantage when a factory produces bulk materials—e.g., sugar, soap, cement, castings, paper, paint, etc.
2. Percentage on Direct Wages method may operate successfully when the skill of the workers and their rates of pay are uniform, the type of equipment they use is fairly similar, and they are all working on the same general class of work.
3. The Direct Labour Hours method is also mostly applicable in such circumstances as are outlined in Paragraph 2. Under such conditions, however, it is likely to be a better method than the Direct Wages method, though possibly involving considerably more work.

THE MACHINE HOUR RATE.

The underlying basis of the Machine Hour Rate is that it distributes expense in proportion to the operating hours of machines. In highly mechanised factories this method can give great accuracy, because so many of the factory cost elements are definitely associated with machine times. A Machine Rate can be set up for each machine, but in a large factory this would mean too many rates for convenience, and generally groups of machines are joined under one rate. The groups should contain only such machines as are alike. A Machine Rate may be built up either by—

1. Including only the direct expense applicable to the machine and using a separate Direct Labour Hour Rate to cover other production overhead. This method is desirable where both manual and machine labour is in operation.
2. Assuming that each machine or group of similar machines is a Cost Department (or Cost or Operating Centre) and establishing a comprehensive rate to cover the whole of the applicable overhead.

In order to compute a Machine Rate, all expenses should be summarised, and then, after analysis, applied to each machine or group thereof. The costs of running a machine would include—

1. The cost of the floor space occupied, including a proportion of general overhead expense applicable to such floor space.
2. The expense of operating the machine, including depreciation, insurance, maintenance, repairs, power, etc.

Wages of the operator may or may not be included.

By dividing the total cost over the number of operating hours a cost per hour would be obtained. (See Figure No. 48).

FIGURE No. 48.

MACHINE HOUR EXPENSE RATE.

	Total.	Machine	Numbers	
	£	1.	2.	3.
Indirect Labour	125	40	55	30
Factory Supplies	100	30	30	40
Repairs	50	25	15	10
Power	25	10	10	5
Light	15	5	5	5
Rent	125	50	50	25
Depreciation	200	100	50	50
Insurance	60	30	15	15
Monthly Cost / (200 hours).	£700	£290	£230	£180

	Machine	Numbers.	
	1	2	3
Hourly Rate	29/-	23/-	18/-
Number of Operators	4	3	2
Machine Hour Rate for Each Operator	7/3	7/8	9/-

If a number of men operate each machine, the Machine Hour Rate is divided by such number to determine the rate applicable to the operator's time. Where one man operates one machine, no adjustment of the Machine Rate is necessary, because the operator's rate would be the same as the Hourly Machine Rate.

Method of Applying Machine Hour Rate.

The steps in applying this rate are—

1. While jobs are in process, post the hours for each machine to the cost sheets.
2. When the job is completed, total the hours for each machine and then enter the machine rates.
3. Multiply the Machine Hours by the Machine Rates and insert the resultant figure.

Advantages of the Machine Rate Method.

These can be set down as under—

1. It takes into account the machine as a vital factor in the Factory Service Distribution.
2. It proceeds on the basis that many Factory Expense items are directly related to the machines, and the expense is apportioned according to the length of time the product is on the machines.
3. It therefore gives greatest accuracy in apportionments.

Disadvantages of the Machine Rate Method.

There are, however, some disadvantages, for instance—

1. Often the method is complicated, and may involve considerable clerical expense.
2. There are many Factory Expense items unrelated to machines and machine times. The accuracy of the method is reduced proportionately as this condition operates, unless special apportionment of such items is adopted.
3. Where machines differ but there are too many to allow a separate Machine Rate for each class of machine, the accuracy of the rates suffers.

In dealing with questions of apportionment, it is important to note and to remember that in practically all cases embracing more than one product and particularly where complex conditions are in operation, the cost of an article can only be estimated; it cannot be determined with scientific accuracy. Frequently the most difficult problem to decide is to what degree refinements should be pursued.

PREDETERMINED EXPENSE BASES.

So far, only actual figures have been examined, but Factory Expense rates may also be based upon predetermined figures. Under this latter method, Factory Costs are estimated at the beginning of a period, and rates are calculated which will absorb, on a predetermined rate of production, the whole of such Factory Expenses. Thus, it may be estimated that total labour hours for a month would be 2500, and the estimated Factory Expense £250 (i.e., 2/- per hour). Predetermined Expense Rates can be applied in relation to all the methods of apportionment used in relation to actual expense.

Necessity for Predetermined Bases.

Under the Job Order method of costing, it is ordinarily necessary to use Factory Expense Rates calculated upon estimates, because—

1. The application of Actual Expense would require all Cost Sheets to be held until all charges to the Factory Expense Account were compiled. Thus the completion of Cost Sheets would be deferred at least until the following month. Job Costs, which should be known as soon as possible after each job is finished, would therefore be delayed.
2. If Actual Factory Expenses are applied on the basis of Actual Hours, the unit cost may fluctuate with changes in (a) Factory Expense and (b) Volume of Production.

When these two factors vary widely, the Unit Cost will change so frequently as to be useless as a guide for selling prices. When predetermined rates are used, Factory Expense is applied to Cost Sheets as the jobs are finished. The bases which can be adopted are similar to those enumerated for Actual Expense.

Procedure to Obtain Predetermined Rates.

It is now proposed to outline the procedure to be adopted in the building up and application of a predetermined Expense Rate in, for example, an engineering organisation. From this it should be possible to follow the cost accounting procedure and the actual cost accounting entries can be considered later. It can be assumed that in the example considered, one overall Factory Expense Rate has been in operation, but it is proposed to operate Departmental Expense Rates in the future. In considering the following steps, reference should be made to Figure No. 49.

1. *Obtain the Total Expense Figures for the last available period.*

These should be obtained for more than one period if possible, so as to give a basis of comparison. These expenses should then be tabulated and if possible divided into functional bases.

2. *Prepare an Expense Budget for the next period.*

After a complete study of prospects for the coming period and the likelihood of the volume of work to be available, a Budget of Expense likely to be incurred for the next period is calculated. These should be worked out for the organisation as a whole.

3. *List the various Production and Service Departments of the Organisation.*

It is assumed in this case that there are Productive and Service Departments. The procedure adopted is the same irrespective of the number of each involved.

4. *Examine each type of Expense and distribute to departments.*

This will involve a thorough analysis of each listed expense and a decision regarding the best bases to be adopted for distribution. The amount of each expense is then distributed to the various departments on those bases.

5. *Total the various Departmental Amounts showing the division between Production and Service Departments.*

The totals of the various expenses are then calculated, a distinction being made between the Production and Service Departments.

FIGURE No. 49.

APPORTIONMENT OF FACTORY EXPENSE.

Code No.		Last Year	Estimated This Year	Foundry	Blacksmiths	Machine Shop	Sheet Metal	Assembly	Power	Stores	Building	Tool Room	Pattern Shop
1011	Supervision	2,250	2,750	450	400	600	300	300	100	200	50	250	100
1012	Inspection	1,250	1,500	300	300	300	300	300					
1013	Indirect Labour	3,300	3,500	350	350	350	350	350	350	350	350	350	350
1014	Storeroom Labour	650	750							750			
1015	Pattern Shop Labour	750	800										800
1016	Tool Room Labour	850	1,000									1,000	
1017	Boiler Room Labour	400	400						400				
1018	Factory Supplies	850	1,000	250	75	550	25	75			25		
1019	Fuel for Steam	1,800	1,500						1,500				
1020	Boiler Room Supplies	1,200	1,210						1,210				
1021	Packing Supplies	600	500					250		250			
1022	Water	650	750	50	50	250			350			50	
1023	Pattern Shop Supplies	250	250										250
1024	Tool Room Supplies	750	800									800	
1025	Small Tools	600	700	25	25	325	25	100	25	25		125	25
1026	Indirect Materials	400	400	100	25	200	25			25	25		
1027	Repairs and Maintenance	3,500	4,000	700	250	1,300	200	200	500	150	200	300	200
1028	Insurance—Fire	500	500	50	25	125	25	25	75	50	50	50	25
1029	Lighting	400	400	50	25	125	25	25	25	25	50	25	25
1030	Heating	350	350	50	25	75	25	25	25	25	50	25	25
1031	Taxes	500	500	50	25	125	25	25	75	50	50	50	25
1032	Stores Expense	500	500							500			
1033	Depreciation	5 000	4,500	800	250	1,650	200	250	750	50	100	250	200
1034	Insurance—Workers' Compensation	2,200	2,250	400	200	1,000	100	100	100	50	50	150	100
1041	General Factory Expense		1,500	181	101	349	81	101	234	125	50	171	107
1042	General Factory Administration Expense		750	90	51	175	41	50	117	62	25	86	53
	Building Expense			179	90	269	90	90	90	89	£1,075	89	89
	Power			1,525	956	2,363	255	127	£5,926			500	200
	Stores			542	107	1,108	246	345		£2,776		246	182
	Pattern Shop			2,456	100	200							£2,756
	Tool Room			100	210	3,206	356	645				£4,517	
		£29,500	£33,060	£8,698	£3,640	£14,645	£2,694	£3,383					
	Amount of Direct Labour			£6,000	£5,000	£25,000	£7,000	£8,000					
	Number of Direct Labour Hours			48,000	37,500	200,000	60,000	50,000					
	Direct Labour Rate			144 96%	72 8%	58 58%	38 48%	42.29%					
	Direct Labour Hourly Rate			3/7.48d.	1 11 3d	1/5.57d.	10 78d	1/4.24d.					

6. *Distribute the Service Departments to Production Departments.*

A decision must be made as to the order in which the Service Departments should be distributed. This will possibly vary in different businesses, but the rule to follow is to distribute first the Service Department which is least affected by surviving Service Departments. This principle should then be adopted for the remaining departments.

7. *Estimate the number of Direct Labour Hours estimated for each Productive Department.*

To do this it will probably be necessary to review the Direct Labour Hours spent in previous periods and future prospects must be taken into account.

8. *Calculate a Departmental Labour Hour Rate in relation to each Department.*

This is a matter of arithmetic but the Labour Hour Rate is then used to calculate charges to job, so as to arrive at Job Costs.

Interlocking Departmental Charges.

Sometimes two Service Departments are interdependent, each servicing the other, and the question arises as to which should be eliminated first. The following example shows a suggested solution—

Suppose that the cost of the Power Department is £500, and the Repairs and Maintenance Department £300. 20% of the total power is used by Repairs and Maintenance and 10% of Repairs and Maintenance by Power. The calculation is made as if the *total* cost of power (without any charge from Repairs & Maintenance) was £500, and as if the *total* cost of Repairs and Maintenance (without any charge from Power) amounted to £300.

Computation.

Power	£500	0	0	Repairs & Maintenance	£300	0	0
10% of £400	40	0	0	20% of Power	100	0	0
10% of additional £8		16	0				
10% of additional 3/2			4		£400	0	0
				20% of additional £40	£8	0	0
				20% of additional 16/-		3	2
				20% of additional 4d.			1
	£540	16	4		£408	3	3

20% of £540 16 4 £108 3 3
10% of £408 3 3 £40 16 4

This is a solution according to what is known as a "trial and error" method.

Usually, however, apportionment is carried out by choosing the department which is least affected by other remaining Service Departments.

Formulae for Predetermined Rates.

The following are the formulae for the preparation of the various Expense Rates as related to predetermined expenses—

1. *Direct Labour Hour Method.*

$$\text{Direct Labour Hour Rate} = \frac{\text{Estimated Factory Expense for month (or period)}}{\text{Estimated total Direct Labour Hours for month (or period)}}$$

2. *Direct Labour Cost Method.*

$$\text{Direct Labour Cost Rate} = \frac{\text{Estimated Factory Expense for month}}{\text{Estimated total Direct Labour Cost for month}}$$

3. *Material Cost Method.*

$$\text{Material Cost Rate} = \frac{\text{Estimated Factory Expense for month}}{\text{Estimated total Materials Cost for month}}$$

4. *Prime Cost Method.*

$$\text{Prime Cost Rate} = \frac{\text{Estimated Factory Expense for month}}{\text{Estimated total Prime Cost for month}}$$

5. *Machine Hour Rate Method.*

$$\text{Machine Hour Rate} = \frac{\text{Estimated Factory Expense chargeable to machine}}{\text{Estimated Machine Operating Hours}}$$

Predetermined Machine Hour Rate Method.

It is necessary to estimate both the total amount of expense for the period affected and also the basic factors governing the method adopted, viz., the total direct labour hours for the Direct Labour Hour Rate Method; the direct labour cost for the Direct Labour Cost Method; the total materials cost for the Materials Cost Method, and the total of the Prime Cost of products to be manufactured in the case of the Prime Cost Method.

With the Machine Hour Rate Method, the total of the various expenses chargeable to each machine must be arrived at, and the estimated machine operating hours. (See Figure No. 50). A further example calculated somewhat differently is shown in Figure No. 51.

Combination of Methods in Departments.

It is sometimes preferable to use two or more methods of distribution even in the same department. There may be a number of expenses which are best distributed under a Machine Hour Rate basis, whilst there may be others of such a nature that this method is quite unsuitable. In such cases the application of two distinct rates can serve a most suitable purpose. Such items as Machine Depreciation, Repairs, Power, Supplies, Insurance, Rent, etc., would be included in the compilation of one or more

Machine Rates, whilst other items which had no relationship to the machine could be included under a Direct Labour Hour Rate. Thus—

Department "A".

Materials	£15
Labour	10
Machine Factory Service Cost— 8 hrs. @ 20/- per hr.	8
Other Factory Service Costs— 10 hrs. @ 4/- per hr.	2
	£35

There is much to recommend this method, as it will frequently be found to give maximum accuracy and yet will be simple to operate.

Use of Supplementary Rate.

Where it is apparent early in a period that the predetermined estimates were either too high or too low, an attempt is frequently made to alter the rates so as to limit the discrepancy between estimated and actual at the end of the period. This is generally done by the use of a Supplementary Rate, by which the original rate is increased or decreased so as to bring the total absorbed more into line with the actual amount of expense which should have been absorbed. The use of the Supplementary Rate is shown in Figure No. 52.

FIGURE No. 50.

PREDETERMINED MACHINE HOUR RATE

MACHINE EXPENSE SCHEDULE.

Machine No. A23.	Description ....
Maker	Date Purchased ....
Power	Cost £600
Additions	Estimated Life 10 years.
	Depreciation 9% per annum.

Item.	*Basis of Estimate.*	*Cost per Annum.*
Interest on Outlay *	Cost, £600. Interest, 5%	£30
Depreciation	9% to reduce to £60 in 10 years	54
Insurance	Actual	2
Repairs & Maintenance	Records of similar machines in previous years	34
Indirect Materials— Oil, Waste, etc.	Previous issues	10
Rent of Floor Space allotted	300 sq. ft. @ 1/4	20
Superintendence & Shop Expenses	One-tenth of estimated total, £1,800	180
Power	300 days, less 10% Idle Time	190
	Cost Per Annum	£520

Number of Operating Hours the machine is expected to run 2080 hours.

Machine Rate = 5/- per hour.

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*A consideration of whether interest should or should not be included will be found in Chapter 30.

If a job took 6 hours of .machine time, the appropriation for Expense would be £1 10 0.

FIGURE No. 51.

PREDETERMINED MACHINE HOUR RATE.

From past experience it is ascertained—

(a) That the effective working life of the machine, having regard to the risk of obsolescence, will be 13,000 hours. The machine cost £400, and has an estimated scrap value of £10.

(b) That the machine will incur an expenditure, based on past results, of £39 in respect of repairs and maintenance.

(c) That the machine consumes 6 units of power per hour at the cost of ½d. per unit.

MACHINE HOUR RATE COMPUTATION.

Machine No. ....
Four Weeks Ending ....

		£	s.	d.
Rent and Rates (rent and rates of department £260 per annum; space occupied by machine one-tenth of department)		2	0	0
Lighting (average cost of departmental lighting for four weeks £6; number of men in department, 20; 1 man engaged on this machine)			6	0
Heating (average cost of departmental heating for four weeks, £3)			3	0
Miscellaneous Expenses:	£ s. d.			
Oil, Waste, etc.	3 0			
Supervisory Labour (Foreman paid £4 per week, engaged in the equal supervision of five machines)	3 4 0	3	7	0
Total Standing Charges		£5	16	0
Hourly Rate for Standing Charges = $\frac{£5\ 16\ 0}{100}$ =			1	2

Machine Expenses:

Depreciation:

Cost of Machine	£400
Less scrap value	10
Amount to be written off	£390

Hourly rate of Depreciation = $\frac{390}{13,000}$ = 7¼d.

Repairs & Maintenance:
Estimated total expenditure £39
Hourly Rate of Expense = $\frac{39}{13,000}$ = 0¾d.

	s.	d.
		8
Power: 6 Units per hr, at ½d. per unit		3
Total Machine Hour Rate	2	1

FIGURE No. 52.

SUPPLEMENTARY EXPENSE RATE.

Department "A".

Materials	£20	0	0
Labour (30 hours)	6	0	0
Factory Expense (30 hrs. @ 8/- per hr.)	12	0	0
Factory Expense — Supplementary Rate of 1/-	1	10	0
	£39	10	0

Department "B".

Materials	£12	0	0
Labour	8	0	0
Factory Expense (20 hrs. @ 10/- per hr.)	10	0	0
Factory Expense — Supplementary Rate of 1/3	1	5	0
	£31	5	0

Differences Between Actual and Estimated Expenses.

Whatever basis is adopted for the allocation of Factory Expense, it will be seen that the use of estimated figures will mean that there will almost inevitably finally be some difference between the amount of the estimate and the actual figure. These differences will be caused by:—

1. The total of the Estimated Expense exceeding the Actual Amount—Spending Variation Loss.
2. The Estimated Expense being less than the Actual Amount—Spending Variation Gain.
3. The Output or Hours Worked being less than estimated.
4. The Output or Hours Worked being more than estimated.
5. Some combinations of the foregoing.

For example: It is estimated that Factory Expense will amount to £1,000 and the number of Direct Labour Hours should be 2,000. The Factory Expense Rate will be 10/- per Direct Labour Hour and expense will be charged to the various products on this basis. At the end of the period it is found that actual Direct Labour Hours were 1,800 and the Factory Expenses totalled £1,100. The balance at the end of the period not absorbed will be £200.

Actual Cost	£1,100
Absorbed 1,800 hours at 10/-	900
Underabsorbed Balance	£200

Actually this would be due to two causes—one, that actual expense exceeded the estimated; and, secondly, that the number of Direct Labour Hours were fewer than was anticipated—

Error in estimate of Factory Cost	£100
Error in estimate of Labour Hours 200 hours @ 10/-	100
Total	£200

Treatment of Over and Under Absorbed Factory Expense.

If the total amount of Factory Expense had been estimated at £2,300, and it actually turned out to be £2,500, it would be necessary to decide upon the method of treating the under-absorbed £200. It should be noted that discrepancies occur because of errors in estimates. It is usually not possible to revise cost computations which have been made throughout the period and the following procedure is therefore indicative of that usually adopted:—

1. Where the estimates have been close and accurate and only small balances have occurred—write these off to Profit and Loss Account through a Manufacturing Cost Adjustment Account.
2. Where the estimates have been astray and there are large balances, adjust by increasing or decreasing
   (a) The Work in Process Account.
   (b) Finished Goods Account.
   with the applicable proportion, writing off the remainder to Profit and Loss Account, thus adjusting the Cost of Sales.
3. Where the estimates are astray because of idle capacity—write off to Idle Capacity Loss in the Profit and Loss Account.

Further consideration will be given later to the problem of Idle Plant Capacity.

Operating Under Predetermined Expense Rates.

The predetermination of Expense Rates is often not an easy matter. It frequently requires analyses of previous results and research into the future. It is often by no means sufficient to accept the operations of the previous year as the sole standard. The next period is almost sure to be different from the current one, because production and business generally are unlikely to remain stationary, but will show some upward or downward tendency. Furthermore, those of an unusual or accidental nature which showed in previous periods should be eliminated. There is nothing absolutely conclusive, final or binding about the estimates of expenses. At the end of each month or some such period the Actual Expenses and the Absorbed Expenses should be shown. If there is an increase of the Actual over the Estimated due to unanticipated increases of salaries, etc., and not as a result of restricted production, an adjustment can be made in the rates to be applied, if thought fit, but it is much more desirable to use the greatest care in predetermining estimates, so that such estimates may be sufficiently accurate to allow the original rates to remain undisturbed until the period has closed. Notwithstanding this desirability, if the efficiency of the system is being impaired or results are quite misleading, no hesitation should be shown in bringing the rates back to more correct figures.

Distinction Between Fixed and Variable Expenses.

The preparation of predetermined rates is facilitated greatly by a knowledge of certain fundamental characteristics in relation to the various classes of expense items. In any business there are certain expenses which vary directly in proportion to production or selling, and others which vary according to one of these without there being any fixed relationship. In addition, there are other costs which are incurred whether there is any activity or not. These various types of cost may be set out as under:—

1. *Fixed Costs.*

These represent that portion of the total cost which exists irrespective of the volume of the business done and without any regard to fluctuations.

Fixed Costs have been divided into three kinds:—

(a) Costs which exist, even if the business was closed down entirely—such as rates, taxes and insurance.

(b) Costs which are incurred in maintaining a minimum organisation as a going concern—such as telephone rental, cleaning, heating and lighting.

(c) Costs which in the ordinary course of running the business are treated as fixed, either from the point of view of usual practice or of policy—such as managerial charges, clerical salaries, etc.

2. *Variable Costs.*

These include all items which ordinarily vary, directly or indirectly, with the amount of production or sales, and bear some relation to such.

Variable Costs can be further divided if desired into True Variable and Partly Variable. The True Variable Cost is one which fluctuates directly in accordance with the production (or in the case of selling expenses, with turnover) and the Partly Variable is one which, whilst increasing with production or sales increases, does not do so in any fixed ratio. It is also necessary to take into account those costs, some of which are fixed, while the others vary. These are sometimes known as Fixed-Variable Costs. In the case of telephone charges, for example, the rental portion is a fixed charge, and would be incurred even though no production or sales took place, unless all services were disconnected. The expense representing call charges would be Partly Variable Cost, as, in most cases, it would probably not increase in direct ratio to any production or sales increase.

The best examples of Variable Costs are the direct items of Materials and Production Labour, which vary almost directly with the amount of production and bear practically a constant relationship to it. Manufacturing supplies can be regarded as being almost of the same type. At the other end of the scale there are such fixed expenses as executive salaries and rent, which do not vary with volume. It is between these two groups that most expenses will be found. They are generally those which vary with volume, but not in any direct ratio. They can be reduced in amount when production volume is decreased, but they cannot be altogether eliminated. For example, foremen's wages may be reduced where volume becomes less (e.g., from £10 per week when factory is extremely busy to £8 per week when things are slack), but it is highly improbable that this expense will fall to the same degree as production. Fixed Variable (or Semi-Variable) Costs really contain a fixed element and a variable element, but here again the latter seldom bears any fixed relation to turnover. The example given above in relation to telephone expenses shows that the fixed portion of this semi-variable item was represented by rental and the variable by call charges. To the extent, therefore, to which semi-variable expenses change with the volume of business, they are variable; to the extent to which they do not change they are non-variable. In order to ascertain the part played by volume in results to be achieved, it is necessary to determine as closely as possible the nature of each type of expense and the classification which can be applied to it.

While Production Expenses have in the main been mentioned, it should be realised that the Selling Expenses can also be divided into similar classifications in relation to turnover. The salary of the Sales Manager would be a Fixed Expense, salesmen's travelling expenses would be Partly Variable, and salesmen's commission (if calculated purely upon sales made) would be True Variable. If salesmen were given a retainer and a commission on sales, their total remuneration would be classed as Fixed Variable, the retainer being the Fixed portion, and the commission being Variable. All of these expenses would, of course, be considered in relation to sales volume.

A clearer conception of the division of expenses may be gained from the following classification, which, however, must be treated as being of general interpretation only, as a Fixed Expense in one business may be Variable in another.

Manufacturing Expense.

Administrative Salaries	Fixed
General Payroll	Portion Fixed Portion Variable Portion Partly Variable
Production Office Salaries	Fixed
Cost Office Salaries	Fixed
Purchase Department Salaries	Fixed
Fuel	Fixed Variable
Power and Light	Fixed Variable
Repairs and Maintenance	Fixed Variable
Insurance	Fixed Variable
Office Supplies	Fixed Variable
Telephone and Telegraph	Fixed Variable
Factory Travelling	Fixed Variable
Freight Inwards	Variable
Materials	Variable
Depreciation — Buildings	Fixed
Rates and Taxes	Fixed
Depreciation—Machinery and Equipment	Fixed Variable

These factors should be borne in mind when predetermining expense, especially where an increase or decrease in production has seriously to be taken into account. A knowledge of these factors and their utilization in the predetermination of expense will make for greater accuracy and therefore less variances.

The use of Fixed and Variable Expense is shown in Figure No. 53. This illustration sets forth the Fixed Expenses (items 1 to 11). Of these 1-7 are purely departmental Fixed Expenses—that is those which actually occur within the department itself and are not first collected in some Service Department and then distributed. Items 8-10 are Fixed Expenses which are first collected and then re-distributed. Items 12-23 show Variable Expenses, 12-19 being purely departmental Variables and 20-22 Variables distributed from other functional Expense Accounts. A normal activity of 30,000 Direct Labour Hours has been assumed and these have been adjusted to one month of 2,000 hours activity. The third column shows the actual expenditure for the month with 2,000 hours activity. The fourth column shows the variances for the month.

FIGURE No. 53.

FACTORY EXPENSE—USE OF FIXED AND VARIABLE EXPENSES.

		1. 100% Normal Year	2. Adjusted to Actual Activity of June	3. Actual Expenses of June	4. Excess of Actual over Budget Expenses
	Fixed Expenses.	£	£	£	£
1.	Foremen's Salaries	720	60	60	
2.	Liability Insurance on Foreman at 1%	7	1	1	
3.	Rent on Factory Building	108	9	9	
4	Depreciation of Machinery and Equipment	72	6	6	
5.	Fire Insurance on Machinery and Equipment	36	3	3	
6.	Taxes on Machinery and Equipment	72	6	6	
7.	Total Departmental Fixed Expenses (1-6)	£1,015	85	85	
8.	Power Fixed Expense apportioned	480	40	40	
9	Compressed Air Fixed Expense apportioned	120	10	10	
10	Total Fixed Expense apportioned from Services (8-10)	£600	50	50	
11	Total Fixed Expense to Expense Account (7 & 10)	£1,615	135	135	
	Variable Expenses.				
12	Indirect Labour	480	32	34	2
13	Liability Insurance on Variable Indirect Labour (12)	5	1	1	—
14	Liability Insurance on Direct Labour	72	5	5	—
15.	Repair Labour	144	10	12	2
16.	Repair Parts	108	7	10	3
17.	Depreciation of Machinery and Equipment	96	6	6	—
18.	Operating Supplies	480	32	40	8
19.	Total Departmental Variable (12-18)	£1,385	93	108	15

FACTORY EXPENSE—USE OF FIXED AND VARIABLE EXPENSES—Continued.

	1. 100% Normal Year	2. Adjusted to Actual Activity of June	3. Actual Expenses of June	4. Excess of Actual over Budget Expenses
Variable Expenses.	£	£	£	£
20. Power Variable Expense apportioned	960	64	80	16
21. Compressed Air Variable Expense apportioned	240	16	17	1
22. Total Variable Expense apportioned from Services (20 & 21)	£1,200	80	97	17
23. Total Variable Expense to Expense Account (19 & 22)	£2,585	173	205	32
24. Total Budgeted (11 & 23)	4,200	308	340	32
25. Total Departmental Fixed and Variable Expenses (7 and 19)	2,400	178	193	15
26. Total Service Fixed and Variable Expenses (10 and 22)	1,800	130	147	17
27. Total Budgeted Expense (25 & 26)	£4,200	308	340	32
28. Activity in Direct Labour or Machine Hours	30,000	2,000	2,000	
29. Expense Rate (24 divided by 28, both at 100%)	2/9·6	3/0·96	3/4·8	

CHAPTER 9.

FACTORY EXPENSE — COST ACCOUNTING PROCEDURE.

Sources of Factory Expense.

It has already been indicated that Factory Expense originates from:—

1. Material Requisitions.
2. Time Cards.
3. Voucher Register.
4. General Journal.
5. Cash Book.

(See Figure No. 54.)

The entries to give effect to Factory Expense accumulated under the foregoing would be:—

1. *Material Requisitions.*

Manufacturing Expense Control A/c. Dr.
To Raw Materials Control A/c. Cr.

2. *Time Cards.*

Manufacturing Expense Control A/c. Dr.
To Accrued Payroll A/c. Cr.

3. *Voucher Register.*

Manufacturing Expense Control A/c. Dr.
To A.B. Lighting Co. Cr.

4. *General Journal.*

Manufacturing Expense Control A/c. Dr.
To Depreciation Reserve A/c. Cr.

5. *Cash Book.*

Manufacturing Expense Control A/c. Dr.
To Bank A/c. Cr.

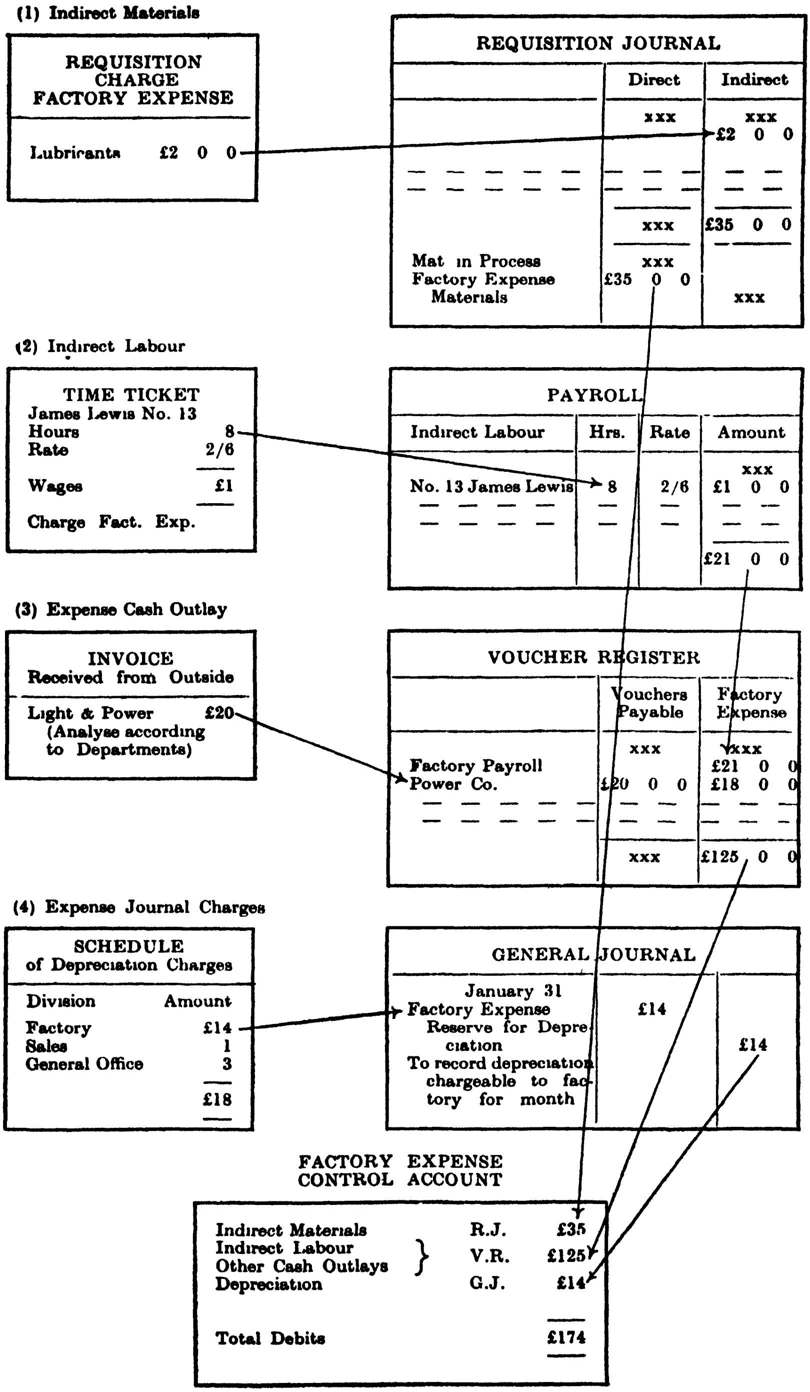
The foregoing entries would have the effect of accumulating various kinds of expenses into one Manufacturing Expense Control A/c. Obviously it is necessary also to have some record of the different types of expense making up the total of the Manufacturing Expense Control A/c. This can be done, if desired, in the Ledger itself, by having a number of accounts, such as Indirect Materials A/c., Indirect Labour A/c., Lighting and Heating A/c., Depreciation A/c., and Factory Postages & Telegrams A/c. (See Figure No. 55.)

Standing Orders.

These individual accounts, however, are usually kept by means of Standing Orders. A Standing Order with a Code Number for easy refer-

FIGURE No. 54.

FLOW OF ACTUAL FACTORY EXPENSE.



(1) Indirect Materials

REQUISITION
CHARGE
FACTORY EXPENSE

Lubricants £2 0 0

REQUISITION JOURNAL

	Direct	Indirect
	xxx	xxx
		£2 0 0
— — — — —	— — —	— —
— — — — —	— — —	— —
	xxx	£35 0 0
Mat in Process	xxx	
Factory Expense	£35 0 0	
Materials		xxx

(2) Indirect Labour

TIME TICKET
James Lewis No. 13
Hours 8
Rate 2/6
Wages £1
Charge Fact. Exp.

PAYROLL

Indirect Labour	Hrs.	Rate	Amount
			xxx
No. 13 James Lewis	8	2/6	£1 0 0
— — — —	—	—	— —
— — — —	—	—	— —
			£21 0 0

(3) Expense Cash Outlay

INVOICE
Received from Outside

Light & Power £20
(Analyse according to Departments)

VOUCHER REGISTER

	Vouchers Payable	Factory Expense
	xxx	xxx
Factory Payroll		£21 0 0
Power Co.	£20 0 0	£18 0 0
— — — — —	— —	— — —
— — — — —	— —	— — —
	xxx	£125 0 0

(4) Expense Journal Charges

SCHEDULE
of Depreciation Charges

Division	Amount
Factory	£14
Sales	1
General Office	3
	£18

GENERAL JOURNAL

January 31		
Factory Expense	£14	
Reserve for Depreciation		£14
To record depreciation chargeable to factory for month		

FACTORY EXPENSE
CONTROL ACCOUNT

Indirect Materials	R.J.	£35
Indirect Labour } Other Cash Outlays }	V.R.	£125
Depreciation	G.J.	£14
Total Debits		£174

Figure No. 55.

FACTORY EXPENSE—GENERAL AND COST LEDGER ENTRIES.

	Original Financial Record	Entry in General Ledger	Original Cost Record	Entry in Cost Records
Various Expense Charges accumulated through Stores Requisitions	Monthly Stores Summary (Voucher Register)	Manufacturing Expense Control A/c. To Stores	Stores Requisitions	Debit appropriate Standing Order (Materials)
Various Expense Charges accumulated through Payroll	Payroll Summary	Manufacturing Expense Control A/c. To Payroll	Job Time Cards	Debit appropriate Standing Order (Labour)
Various Expense Charges accumulated through Cost Journal or Voucher Register	Journal or Voucher Register	Manufacturing Expense To Reserve for Depreciation Insurance	Cost Journal	Debit appropriate Standing Order (Expense)
To Record Departmentalization of Factory Expense	Journal	Dr. Various Departmental Expense A/cs. Cr. Manufacturing Expense Control A/c.	Nil	Nil (as departmentalization already arranged through Standing Orders)
To Record distribution of Service Department Expense to Production Departments	Journal	Dr. Manufacturing Expense Control A/c. Cr. Service Dept. Expense Control A/c.	Nil	Nil
To Record Manufacturing Expense applied to Production	Journal	Dr. Manufacturing Expense in Process. Credit Applied Manufacturing Expense.	Summary of Applied Expense	Debit Manufacturing Expense Section Production Orders Credit Standing Orders

ence, is usually provided in relation to the various kinds of Manufacturing Expense, e.g.:—

A/c. No.	**1011**	**Factory Supervision**
	1012	**Shop Inspection**
	1013	**Indirect Labour**
	1014	**Storeroom Labour.**
	1015	**Pattern Shop Labour**
	1016	**Toolroom Labour**
	1017	**Boiler Room Labour**
	1018	**Factory Supplies**
	1019	**Fuel for Steam**
	1020	**Boiler Room Supplies**
	1021	**Packing Supplies**
	1022	Water
	1023	Pattern Shop Supplies
	1024	Toolroom Supplies
	1025	Small Tools
	1026	Indirect Materials.
	1027	Repairs and Maintenance
	1028	Fire Insurance
	1029	Lighting
	1030	Heating
	1031	Taxes
	1032	Stores Expense
	1033	Depreciation
	1034	Insurance—Workers' Compensation.
	1041	General Factory Expense
	1042	General Factory Administration Expense.

FIGURE NO. 56.

CHART OF STANDING OR UNPRODUCTIVE ORDERS.

Standing Orders		Departments.			
Nos.		1	2	3	4
1	Supervision	11	21	31	41
2	Cleaning	12	22	32	42
3	Maintenance	13	23	33	43
4	Spoiled Work	14	24	34	44
5	Reconditioning Rejects	15	25	35	45
6	Waiting Time	16	26	36	46

Standing Orders are operated in the following way:—

(a) They may be symbolised with numbers common to all departments (in Figure No. 56, Maintenance in each Department is "3").

(b) Each department may be given a numerical prefix to indicate the Department.

(c) When employees are engaged on Standing Order work, the time is charged to the number which indicates its nature and the Department in which it has occurred.

(d) Time to be spent on unproductive work should be authorised by the Departmental Foreman.

(e) In the Factory Ledger the labour element cost of the Standing Orders is credited to the Wages Account and debited to the appropriate accounts.

(f) Each month the Budgeted Manufacturing Expense allowance for each Standing Order is credited to the Standing Order account and is debited to the Manufacturing Expense of each Department.

(g) The balance remaining on each Standing Order Account representing a loss or gain on the Budget which is shown separately in the Manufacturing Report prepared from the Factory Ledger.

(h) Details of the Standing Orders should be included in the weekly departmental Labour Reports and compared with the Budgeted figures.

(See also Figure No. 10.)

Accounting Entries.

As the various items of Factory Expense are incurred the entries flow through and are entered in the appropriate column of the relevant Standing Order. At the end of a period, therefore, the total amount of expense paid or incurred in connection with any individual Expense Account is shown on the Standing Order and if the totals of all amounts posted to the Standing Orders are also posted to the Manufacturing Expense Control A/c., it should be obvious that the total of balances of all Standing Orders will equal the total of the Manufacturing Expense Control A/c.

When Finished Goods are turned out, the cost of such is compiled from the Materials and Labour entering into them, together with that proportion of Factory Expense applicable. This latter is calculated according to some such method as has been explained in previous chapters, but it is necessary to enter the amount thus applied to the credit of the Standing Order, and also in total to the Credit of the Manufacturing Expense Control A/c. Thus it means that all the expenses incurred are debited to the various Standing Orders and all the expenses applied are credited to such. Likewise, the totals of the expenses incurred having already been debited to the Manufacturing Expense Control Account, credits for expenses applied must also be shown. At any time, therefore, Standing Order No. 1011, representing Factory Supervision would show a total of debit postings covering the cost of supervision up to a specified period, and the total of the credits would indicate the amount charged out to various jobs for supervision. The balance would indicate the amount of expense which had not yet been applied to work being carried out. This statement in relation to supervision would also apply to all other Standing Orders. By making total postings to the Manufacturing Expense Control A/c. therefore, the total debit postings would represent the total of all expenses paid or incurred, and the total credit postings would represent the amounts charged out to various finished jobs. The difference would not yet have been applied. (See Figure No. 57.)

Departmentalisation of Factory Expense.

The foregoing illustrates the simplest procedure in relation to Manufacturing Expense, and ignores any attempt or necessity for Departmentalisation. It may be, however, that a business would be comprised of a number of Departments, and some products would use much more than others. Indeed, some products may miss certain Departments altogether. If, therefore, an Overall Rate in relation to the whole business was applied to all products, inaccurate results would follow. By Departmentalising, a departmental distribution would be possible, and this would give accuracy and much fairer distribution to all products. The necessity for Departmentalisation, however, brings into account Service Departments. In any final analysis it is necessary to make distributions to Productive Departments, and therefore an accounting procedure must be evolved which will allow a fair distribution of Service Departments to those concerned with manufacturing.

Obviously, it is therefore necessary to give Accounting form to the Departmentalisation of expense.

FIGURE No. 57.

APPLIED MANUFACTURING EXPENSE.

Manufacturing Expense Control Account.

'31				'31			
Jan. 1.	To	Materials Summary	£540	Jan. 1.	By	Prod. Orders Work in Progress	£1,220
	„	Payroll	860		„	Repair Orders Work in Progress	110
	„	Journal	250		„	Plant Orders Work in Progress	140
					„	Balance	180
			£1,650				£1,650

Amount of Expense Unabsorbed = £180

The first step is to take each type of expense, ascertain the correct basis of apportionment, and spread the total expense involved to the various Departments affected.

(In the following entries it is assumed that the figures covered by Figure No. 49 are actual, not pre-determined figures.)

The following Journal entry would be necessary to record the items covered by the factory expenses included in Figure No. 49.

Debit	Supervision	£2750	
	Inspection	1500	
	Indirect Labour	3500	
	Storeroom Labour	750	
	Pattern Shop Labour	800	
	Toolroom Labour	1000	
	Boiler Room Labour	400	
	Factory Supplies	1000	
	Fuel for Steam	1500	
	Boiler Room Supplies	1210	
	Packing Supplies	500	
	Water	750	
	Pattern Shop Supplies	250	
	Tool Room Supplies	800	
	Small Tools	700	
	Indirect Materials	400	
	Repairs and Maintenance	4000	
	Insurance	500	
	Lighting	400	
	Heating	350	
	Taxes	500	
	Stores Expense	500	
	Depreciation	4500	
	Insurance—Workers' Compensation	2250	
	General Factory Expense	1500	
	General Factory Administration Expense	750	
	Credit Sundry A/cs. (e.g., Accounts Payable)		£33,060

The second step is to apportion these various expenses to the departments affected by such expenses. This obviously involves fixing upon a basis of apportionment in relation to each individual expense.

Supervision £2,750.

Basis of Apportionment—analysis of functions of Supervisors.

Foundry	£450	Power	£100
Blacksmiths	400	Stores	200
Machine Shop	600	Building	50
Sheet Metal	300	Toolroom	250
Assembly	300	Pattern Shop	100

Inspection £1,500.

Basis of Apportionment—analysis of functions of Inspection. To be divided equally between Productive Departments.

Foundry	£300	Machine Shop	£300
Assembly	300	Blacksmiths	300
Sheet Metal	300		

Indirect Labour £3,500.

Basis of Apportionment—analysis of functions and figures for two previous periods. To be divided equally between all departments.

Foundry	£350	Power	£350
Blacksmiths	350	Stores	350
Machine Shop	350	Building	350
Sheet Metal	350	Toolroom	350
Assembly	350	Pattern Shop	350

Storeroom Labour £750.

Basis of Apportionment—Direct to Stores Dept.

Pattern Shop Labour £800.

Basis of Apportionment—Direct to Pattern Shop.

Toolroom Labour £1,000.

Basis of Apportionment—Direct to Toolroom.

Boiler Room Labour £400.

Basis of Apportionment—Direct to Power.

Factory Supplies £1,000.

Basis of Apportionment—Amounts of preceding period and an analysis of requirements in the coming period.

Foundry	£250	Assembly	£75
Blacksmiths	75	Building	25
Machine Shop	550	Sheet Metal	25

Fuel for Steam £1,500.

Basis of Apportionment—Direct to Power.

Boiler Room Supplies £1,210.

Basis of Apportionment—Direct to Power.

Packing Supplies £500.

Basis of Apportionment—half to Assembly, half to Stores.

Assembly	£250	Stores	£250

Water £750.

Basis of Apportionment—Amounts of preceding period and an analysis of requirements in the coming period.

Foundry	£50	Power	£350
Blacksmiths	50	Toolroom	50
Machine Shop	250		

Pattern Shop Supplies £250.

Basis of Apportionment—Direct to Pattern Shop.

Toolroom Supplies £800.

Basis of Apportionment—Direct to Toolroom.

Small Tools £700.

Basis of Apportionment—Expected use.

Foundry	£25	Power	£25
Blacksmiths	25	Stores	25
Toolroom	125	Machine Shop	325
Sheet Metal	25	Pattern Shop	25
Assembly	100		

Indirect Materials £400.

Basis of Apportionment—Amounts of preceding period and an analysis of requirements in the coming period.

Foundry	£100	Stores	£25
Blacksmiths	25	Building	25
Machine Shop	200	Sheet Metal	25

Repairs & Maintenance £4,000.

Basis of Apportionment—Actual cost for preceding period with allowance for changes during coming period.

Foundry	£700	Stores	£150
Blacksmiths	250	Power	500
Machine Shop	1300	Building	200
Sheet Metal	200	Toolroom	300
Assembly	200	Pattern Shop	200

Insurance £500.

Basis of Apportionment—Values in each Dept.

Foundry	10%	£50	Power	15%	£75
Blacksmiths	5%	25	Stores	10%	50
Machine Shop	25%	125	Building	10%	50
Sheet Metal	5%	25	Toolroom	10%	50
Assembly	5%	25	Pattern Shop	5%	25

Lighting £400.

Basis of Apportionment—Estimated Candlepower hours based on previous period.

Foundry	£50	Power	£25
Blacksmiths	25	Stores	25
Machine Shop	125	Building	50
Sheet Metal	25	Tool Room	25
Assembly	25	Pattern Shop	25

Heating £350.

Basis of Apportionment—Prorated on the basis of the expected use of heating.

Foundry	£50	Power	£25
Blacksmiths	25	Stores	25
Machine Shop	75	Building	50
Sheet Metal	25	Tool Room	25
Assembly	25	Pattern Shop	25

Taxes £500.

Basis of Apportionment—Values in each Department.

Foundry	10%	£50	Power	15%	£75
Blacksmiths	5%	25	Stores	10%	50
Machine Shop	25%	125	Building	10%	50
Sheet Metal	5%	25	Toolroom	10%	50
Assembly	5%	25	Pattern Shop	5%	25

Stores Expense £500.

Basis of Apportionment—Direct to Stores Dept.

Depreciation £4,500.

Basis of Apportionment—On departmental values of plant, etc., on which depreciation is calculated.

Foundry	£800	Power	£750
Blacksmiths	250	Stores	50
Machine Shop	1650	Building	100
Sheet Metal	200	Toolroom	250
Assembly	250	Pattern Shop	200

Insurance—Workers' Compensation £2,250.

Basis of Apportionment—Estimated payroll of various departments for coming period.

Foundry	£400	Power	£100
Blacksmiths	200	Stores	50
Machine Shop	1,000	Building	50
Sheet Metal	100	Toolroom	150
Assembly	100	Pattern Shop	100

In order to spread the expense items mentioned above upon the bases described in the last Chapter, the Journal entries would be:—

Debit	Foundry	£450	
	Blacksmiths	400	
	Machine Shop	600	
	Sheet Metal	300	
	Assembly	300	
	Power	100	
	Stores	200	
	Buildings	50	
	Toolroom	250	
	Pattern Shop	100	
	Credit Supervision		£2,750

(Being apportionment of Supervision costs on the basis of functions of Supervisors.)

Debit	Foundry	£300	
	Blacksmiths	300	
	Machine Shop	300	
	Sheet Metal	300	
	Assembly	300	
	Credit Inspection		£1500

(Being apportionment of Inspection Costs according to functions of Inspectors.)

Debit	Foundry	£350	
	Blacksmiths	350	
	Machine Shop	350	
	Sheet Metal	350	
	Assembly	350	
	Power	350	
	Stores	350	
	Building	350	
	Toolroom	350	
	Pattern Shop	350	
	Credit Indirect Labour		£3500

(Being apportionment of Indirect Labour on basis of analysis of functions.)

Debit	Stores Department	£750	
	Credit Storeroom Labour		£750

(Being transfer as above.)

Debit	Pattern Shop	£800	
	Credit Pattern Shop Labour		£800

(Being transfer as above.)

Debit	Toolroom	£1000	
	Credit Toolroom Labour		£1000

(Being transfer as above.)

Debit	Power	£400	
	Credit Boilerroom Labour		£400

(Being transfer as above.)

Debit	Foundry	£250	
	Blacksmith	75	
	Machine Shop	550	
	Sheet Metal	25	
	Assembly	75	
	Building	25	
	Credit Factory Supplies		£1000

(Being distribution of factory supplies according to original requisitions, etc.)

Debit	Power	£1500	
	Credit Fuel for Steam		£1500

(Being transfer as above.)

Debit	Power	£1210	
	Credit Boiler room supplies		£1210

(Being transfer as above.)

Debit	Assembly	£250	
	Stores	250	
	Credit Packing Supplies		£500

(Being apportionment of Packing, according to use.)

Debit	Foundry	£50	
	Blacksmith	50	
	Machine Shop	250	
	Power	350	
	Toolroom	50	
	Credit Water		£750

(Being apportionment of Water according to usage.)

Debit	Pattern Shop	£250	
	Credit Pattern Shop Supplies		£250

(Being transfer as above.)

Debit	Toolroom	£800	
	Credit Toolroom Supplies		£800

(Being transfer as above.)

Debit	Foundry	£25	
	Blacksmiths	25	
	Machine Shop	325	
	Sheet Metal	25	
	Assembly	100	
	Power	25	
	Stores	25	
	Toolroom	125	
	Pattern Shop	25	
	Credit Small Tools		£700

(Being apportionment of Small Tools used on basis of actual usage.)

Debit	Foundry	£100	
	Blacksmiths	25	
	Machine Shop	200	
	Sheet Metal	25	
	Stores	25	
	Building	25	
	Credit Indirect Materials		£400

(Being apportionment of Materials used by Departments.)

Debit	Foundry	£700	
	Blacksmiths	250	
	Machine Shop	1300	
	Sheet Metal	200	
	Assembly	200	
	Power	500	
	Stores	150	
	Building	200	
	Toolroom	300	
	Pattern Shop	200	
	Credit Repairs and Maintenance		£4000

(Being apportionment of Repairs carried out in each Department.)

Debit	**Foundry**	**£50**	
	Blacksmiths	**25**	
	Machine Shop	**125**	
	Sheet Metal	**25**	
	Assembly	**25**	
	Power	**75**	
	Stores	**50**	
	Building	**50**	
	Toolroom	**50**	
	Pattern Shop	**25**	
	Credit Fire Insurance		**£500**

(Being apportionment of Fire Insurance on basis of values in each Department.)

Debit	Foundry	£50	
	Blacksmiths	25	
	Machine Shop	125	
	Sheet Metal	25	
	Assembly	25	
	Power	25	
	Stores	25	
	Building	50	
	Toolroom	25	
	Pattern Shop	25	
	Credit Lighting		£400

(Being apportionment on basis of Candle Power Hours used in each Department.)

Debit	Foundry	£50	
	Blacksmiths	25	
	Machine Shop	75	
	Sheet Metal	25	
	Assembly	25	
	Power	25	
	Stores	25	
	Building	50	
	Toolroom	25	
	Pattern Shop	25	
	Credit Heating		£350

(Being apportionment on basis of Departmental use of Heating.)

Debit	Foundry	£50	
	Blacksmiths	25	
	Machine Shop	125	
	Sheet Metal	25	
	Assembly	25	
	Power	75	
	Stores	50	
	Building	50	
	Toolroom	50	
	Pattern Shop	25	
	Credit Taxes		£500

(Being apportionment on basis of Departmental values.)

Debit	Stores	£500	
	Credit Stores Expense		£500

(Being transfer as above.)

Debit	Foundry	£800	
	Blacksmiths	250	
	Machine Shop	1650	
	Sheet Metal	200	
	Assembly	250	
	Power	750	
	Stores	50	
	Building	100	
	Toolroom	250	
	Pattern Shop	200	
	Credit Depreciation		£4500

(Being apportionment on basis of Departmental Plant values, at allowable rates.)

Debit	Foundry	£400	
	Blacksmiths	200	
	Machine Shop	1000	
	Sheet Metal	100	
	Assembly	100	
	Power	100	
	Stores	50	
	Building	50	
	Toolroom	150	
	Pattern Shop	100	
	Credit Insurance—Workers' Compensation		£2250

(Being apportionment according to Departmental Payroll—for period.)

It will be remembered that General Factory Expense £1500 and General Factory Administration Expense, £750, were distributed on the basis of total of other departmental expenses. The necessary entries to give effect to this would be:—

Debit	Foundry	£181	
	Blacksmiths	101	
	Machine Shop	349	
	Sheet Metal	81	
	Assembly	101	
	Power	234	
	Stores	125	
	Building	50	
	Toolroom	171	
	Pattern Shop	107	
	Credit General Factory Expense		£1500

(Being apportionment as above.)

Debit	Foundry	£90	
	Blacksmiths	51	
	Machine Shop	175	
	Sheet Metal	41	
	Assembly	50	
	Power	117	
	Stores	62	
	Building	25	
	Toolroom	86	
	Pattern Shop	53	
	Credit General Factory Administration Expense		£750

(Being apportionment as above.)

It would then become necessary to spread the amounts of Factory Expense incurred by the various Service Departments to the Manufacturing Departments, and the Journal entries necessary to give effect to these are as under:—

Debit	Foundry	£179	
	Blacksmiths	90	
	Machine Shop	269	
	Sheet Metal	90	
	Assembly	90	
	Power	90	
	Stores	89	
	Toolroom	89	
	Pattern Shop	89	
	Credit Building Expense		£1075

(Being apportionment of Building Expense on the basis of space occupied.)

Debit	Foundry	£1525	
	Blacksmiths	956	
	Machine Shop	2363	
	Sheet Metal	255	
	Assembly	127	
	Toolroom	500	
	Pattern Shop	200	
	Credit Power		£5926

(Being apportionment of Power according to use by Departments.)

Debit	Foundry	£542	
	Blacksmiths	107	
	Machine Shop	1108	
	Sheet Metal	246	
	Assembly	345	
	Toolroom	246	
	Pattern Shop	182	
	Credit Stores		£2776

(Being apportionment of Stores Expense on basis of Materials used.)

Debit	Foundry	£2456	
	Blacksmiths	100	
	Machine Shop	200	
	Credit Pattern Shop		£2756

(Being apportionment on basis of patterns made for Departments.)

Debit	Foundry	£100	
	Blacksmiths	210	
	Machine Shop	3206	
	Sheet Metal	356	
	Assembly	645	
	Credit Toolroom		£4517

(Being apportionment of Toolroom expense on the basis of value of tools made for each Department.)

The foregoing entries would have the effect of transferring all items of Manufacturing Expense to the five manufacturing departments and the debit balance in each at this stage would be:—

Foundry	£8698
Blacksmiths	3640
Machine Shop	14,645
Sheet Metal	2694
Assembly	3383

The next step would be to apportion the amount of Departmental Expense to the work actually carried out within the Departments. The exact method of treatment largely depends upon the type of account involved and it is proposed to examine the procedure, firstly, in relation to Job Costs and, secondly, in connection with Process Costs.

1. *Job Costs.*

To spread the Departmental Costs to the various jobs, it is first necessary to arrive at the Departmental Rate. It is assumed in this case that a Direct Labour Rate is arrived at. This would be obtained by taking the amount of Departmental Expense and expressing this as a percentage of the Direct Labour involved in each department. Figure No. 49 shows these figures, which are as under:—

Foundry	144.96% of Direct Labour
Blacksmiths	72.8%
Machine Shop	58.58%
Sheet Metal	38.48%
Assembly	42.29%

From the various Time Cards and Payroll summaries the amount of the Direct Labour in relation to each job will have been accumulated. It is the total of the various amounts applied to each job which will give the total departmental figure. Therefore if labour in the Foundry expended on Product A, amounted to £1000, the amount of expense applicable to Product A, would be £1449/12/-. This is arrived at as under:—

£1000 multiplied by 144.96%

As the total Direct Labour of all jobs would equal the total Direct Labour of the Department, the total of all Applied Expense should equal the total of the Departmental Expense. This principle would also apply to all Departments, thus ensuring that the total Manufacturing Expenses of the business find their way into the total work carried out by the business.

The necessary Journal entries to give effect to the foregoing would be as under:—

Debit	Work in Process—Foundry	£8698	
	Credit Foundry Expenses		£8698
Debit	Work in Process—Blacksmiths	£3640	
	Credit Blacksmiths Expense		£3640
Debit	Work in Process—Machine Shop	£14,645	
	Credit Machine Shop Expense		£14,645
Debit	Work in Process—Sheet Metal	£2694	
	Credit Sheet Metal Expense		£2694
Debit	Work in Process—Assembly	£3383	
	Credit Assembly Expense		£3383

Where it is not desired to keep separate Departmental Work in Process Accounts, the foregoing entries could be summarised as under:—

Debit	Work in Process Account	£33,060	
	Credit Foundry Expense		£8698
	Blacksmiths		3640
	Machine Shop		14,645
	Sheet Metal		2694
	Assembly		3383

It is still necessary to see that the running costs of the various jobs are recorded. This would be effected by charges to the various cost sheets relating to each job in the Factory Expense Column.

It should be noted that the total shown thereon should agree with the Control A/c., which would be included in the total Work in Process Account.

2. *Process Costs.*

Where Process Costs are in operation it will be remembered that the finished product of one Department becomes virtually the raw material of the next. If, therefore, there were five Departments with figures similar to those given in the above illustration, the position would be:—

Debit	Department No. 1	Factory Expense	£8698	
	2	„ „	3640	
	3	„ „	14,645	
	4	„ „	2694	
	5	„ „	3383	
	Credit Manufacturing Expense Control Account			£33,060

(Being summary of Departmental Expense.)

As the product goes from Dept. 1 to Dept. 2, it is necessary to transfer the value of the finished production from the former to the latter. This would be done by the following Journal entry:—

Debit	Dept. 2—Work in Process	£ Z	
	Credit Dept 1.—Work in Process		£ Z

(Being transfer of work in process from Dept. 1 to Dept. 2, as under:—

Materials	x
Labour	y
Expense	£8698

= £ Z.)

Subsequent transfers from Dept. 2 to Dept. 3, and so on to Dept. 5, would be made in a similar manner. Finally, the finished goods would be transferred from Dept. 5 to Finished Goods Account.

Predetermined Expenses.

So far attention has been directed to the apportionment of actual expenses to the various jobs, but it was pointed out in the previous Chapter that it is not always desirable to wait until the end of the period before the cost of a job can be obtained. This necessitates the use of Predetermined Rates and these must ultimately be compared with actual figures, so as to arrive at any discrepancy between the two. With Predetermined Rates, the Estimated Expense, either in relation to the business as a whole or the various departments is calculated, together with the other factor necessary for the computation of an Expense Rate, or Departmental Expense Rates, viz., the time or unit factor. It will be remembered that Figure No. 49, was actually prepared on this basis, and whilst it has been used to represent Actual Expense it would have formed the basis of a Budgeted estimate of what the expense would be in the case of predetermined rates. In such a case the rates arrived at would be Estimated Rates and these would be used for allocation to the various jobs. The use of Predetermined Rates rarely occurs in process costs, but is the usual method with Job Costs.

Whilst the use of Predetermined Rates solves the difficulty of having to wait until the end of a period before costs can be obtained, it in turn raises the complexity of Over- or Under-Absorbed Expense. This matter has previously been referred to. With Predetermined Rates, the Actual Expenses incurred are accumulated in the ordinary way, and to this extent the method appearing in the earlier part of this Chapter applies. The amounts of expense applied to the various jobs, however, would have been calculated according to the Predetermined Rates, and the debits in the Cost Sheets would find their corresponding credits in the various Standing Orders. Likewise, the totals of the Applied Expense credited to the various Standing Orders would in one total be credited to a Control A/c., which is usually called Applied Manufacturing Expense A/c. The following position would therefore develop:—

1. An estimate of various expenses would be arrived at, and rates to be applied calculated.
2. As various jobs went through the factory, credits covering applied expense at the Predetermined Rates would be credited to the Standing Orders and debited to the Job Cost Sheets.
3. Total of all amounts thus applied would be shown in Summary Form and would be credited to Applied Manufacturing Expense A/c. in the Ledger.
4. As actual expenses were incurred they would be debited to the various Standing Orders.
5. A summary of all such debits would be prepared to check with the total posting to the debit of the Manufacturing Expense Control A/c. in the General Ledger.
6. The difference between the Manufacturing Expense Control A/c. and the Applied Manufacturing Expense A/c. would represent the amount of Under- or Over-applied Factory Expense. If the former was the larger, expense would have been under applied, and if it was the smaller, expense would have been over applied.

7. The over- or under-absorption could be treated as under:—

(a) Transferred to P. & L. A/c., the entry being for under-absorption:—

Debit P. & L. A/c.
To Applied Manufacturing Expense A/c. Credit

and for over-absorption:—

Debit Applied Manufacturing Expense A/c.,
To P. & L. A/c. Credit.

(b) Adjust the finished stock and the work in process by increasing or decreasing the amounts applied to the various jobs. In the case of an under-absorption the entry would be:—

Debit Finished Stock
Work in Process
To Applied Manufacturing Expense A/c. Credit.

In the case of an over-absorption it would be:—

Debit Applied Manufacturing Expense A/c.
To Finished Goods Credit
Work in Process Credit

The foregoing entries have assumed that the business is not Departmentalised. If there were five Departments, for example, it would be necessary to have Applied Departmental Expense Accounts, and it should be noted that the Expense of one Department could be under-absorbed, whilst the expense of another Department is over-absorbed. In such a case, adjustments would have to be upon a Departmental basis. If, for example, it is desired to adjust both Finished Goods and Work in Process in relation to both under- or over-absorptions in each Department. the entry would be:—

Debit Finished Goods
Work in Process
To Foundry Expense Credit
Blacksmith
Sheet Metal

(Being adjustment of expense under-absorbed.)

Debit Machine Shop
Assembly
To Finished Goods
Work in Process Credit

(Adjustment of expense rates over-absorbed.)

Further Cost Accounting entries necessary to control both Work in Process and Finished Goods are shown in the next Chapter.

CHAPTER 10.

WORK IN PROCESS AND FINISHED STOCK CONTROL.

One of the fundamental differences between Cost and General Accounting is to be found in the fact that, in the case of the former, such accounts as Raw Materials, Goods in Process, Finished Goods of Finished **Parts** Accounts, continuously represent the cost of the stocks on hand as related to the particular accounts. If no margin of error of any kind had to be allowed for, a Physical Inventory would merely disclose the same figures as set forth by the accounts enumerated. Therein lies the important factor in Perpetual Inventories.

Cost Accounting control is obtained by exercising the necessary measure of control over materials, labour and expense, and the methods whereby this is facilitated have been outlined in previous chapters.

Control is exercised over:—

1. Cost of Material Purchased and Consumed and Changes in Value of Materials Stocks.
2. Cost of Direct and Indirect Labour.
3. Amount of Manufacturing Expense.

In connection with Manufacturing Expense, control operates in relation to total, to amounts chargeable to various Departments, to distribution of Service Departments Expense and to the application of expense to products.

WORK IN PROCESS.

The ultimate aim of the foregoing is to arrive at the cost of the goods sold, so that the margin of profit operating may be continuously known. Before this is ascertained, however, entries in connection with the Work in Process Account are necessary.

As indicated previously, Materials, Labour and Expense (the latter Actual or Applied) find their way into the Work in Process Account. This can be done in a number of ways, e.g.—

Job Costs.

Work in Process A/c.	Dr. £50	
To Raw Materials A/c.		Cr. £50
Work in Process A/c.	Dr. £30	
To Wages A/c.		Cr. £30
Work in Process A/c.	Dr. £20	
To Manufacturing Expense Control A/c. (or Applied Manufacturing Expense A/c.)		Cr. £20

or

Materials in Process A/c.	Dr. £50	
To Raw Materials A/c.		Cr. £50
Labour in Process A/c.	Dr. £30	
To Wages A/c.		Cr. £30
Manufacturing Expense in Process A/c.	Dr. £20	
To Manufacturing Expense Control A/c. (or Applied Manufacturing Expense A/c.)		Cr. £20

When work is completed and takes the form of Finished Goods or Finished Parts, it becomes necessary to make a transfer from Work in Process to Finished Goods. The entry would be:—

Finished Goods (or Assembled Parts) A/c.	Dr. £100	
To Work in Process A/c.		Cr. £100

or

Finished Goods (or Assembled Parts) A/c.	Dr. £100	
To Materials in Process A/c.		Cr. £50
Labour in Process A/c.		Cr. £30
Manufacturing Expense in Process A/c.		Cr. £20

In order to effect this entry it becomes necessary to arrive at the value of the Finished Goods or Parts to be transferred. This value would be obtained from the Cost Sheet which would show the amount of Materials, Labour and Expense expended on the job. Concurrently with passing the above entry therefore, a credit entry closing the Job Cost Sheet would be made. Thus that job would no longer form part of Work in Process and there would also be no open Cost Sheet for the job.

Process Costs.

The procedure in relation to Process Costs is somewhat different from Job Costs. The Departmental Costs find their way into the Work in Process Accounts in the following manner:—

Work in Process—Dept. "A"	Dr. £30	
Work in Process—Dept. "B"	Dr. £20	
To Raw Materials A/c.		Cr. £50
Work in Process—Dept. "A"	Dr. £20	
Work in Process—Dept. "B"	Dr. £10	
To Wages A/c.		Cr. £30
Work in Process—Dept. "A"	Dr. £10	
Work in Process—Dept. "B"	Dr. £10	
To Manufacturing Expense A/c.		Cr. £20

In this latter case, the whole of the work completed by Dept. "A" may be transferred to Dept. "B" for further treatment. The value of the work would then be transferred thus:—

Work in Process—Dept. "B"	Dr. £60	
To Work in Process—Dept. "A"		Cr. £60

It should be noted that only completed work would be thus transferred and, in order to make the entry, it would be necessary to arrive at the value of either the completed or the uncompleted work in Dept. "A".

When work is completed and takes the form of Finished Goods, or Finished Parts, a transfer must be made out of the last departmental Work in Process A/c., thus:—

Finished Goods (or Assembled Parts) A/c.	Dr. £100	
To Work in Process:—		
Last Dept., e.g., Dept. "G"		Cr. £100

With process costs the total cost would be divided by the number of completed products, or the weight of such, e.g., if the total work in process represented £100, and nine tons of product was completed with £5/10/- as the value of the uncompleted work, the cost per ton of completed goods would be £10.

FINISHED GOODS ACCOUNTS.

With both Job and Process Costs the treatment of Finished Goods is practically the same.

(a) In Job Costing, as the order is completed, the Despatch Department or a Production Department, notifies the Cost Department which in turn completes the Cost Sheet.

(b) The summaries of the Cost Sheets which show the totals of Actual Material, Labour and Expense expended are then posted to the Finished Work Analysis.

(c) In Process Costing, Reports are received daily from Foremen of each process or from a Production Department showing the work completed at each point of production.

(d) From the Process Cost Sheets, these Reports are valued at the average cost of the total output for the process.

(e) With Standard Costing, instead of using the actual costs (Job Costing) or the average costs (Process Costing), a standard value is used for the completed job or for the product at the point of production at which the report is made, this Standard Value, divided into Material, Labour and Expense, being entered on the Finished Work Analysis.

A Finished Work Analysis is used:

(a) To provide a summary of the costs of completed production.

(b) To obtain the value of work transferred from one department to another. It would be the basis of an entry in the Factory Journal debiting the Work in Process Account for the succeeding Department and crediting the Work in Process Account of that Department which has finished the work.

(c) To provide the debit to Warehouse Stock and the credits to the Work in Process Accounts in the Factory Ledger.

Just as Manufacturing Expense Control A/c. controls Standing Orders and Work in Process A/c. covers the value of Cost Sheets, so Finished Goods A/c. covers the balances of individual Finished Goods Accounts in the Finished Goods Ledger, or in the Stock Ledger where this includes Finished Goods as well as Raw Materials.

When goods are sold, it becomes necessary to transfer from Finished Goods A/c. to Cost of Sales, the entry being:—

Cost of Sales Debit
To Finished Goods A/c. Credit

The goods would be transferred on some approved basis, such as first-in, first-out, or average cost method, e.g.:—

Product "A"

Jan. 1.			Jan. 10.		
To Stock on Hand	(10)	£9 10 0	By Cost of Sales	(4)	£3 18 0
Jan. 31.			Jan. 31.		
To Mnfd. Stock	(10)	10 0 0	By Balance	(16)	15 12 0
		£19 10 0			£19 10 0
Feb. 1.					
To Balance		£15 12 0			

The above example is based on the Average Cost Method (monthly average), but the First-in- First-out Method could be used.

One of the primary objects of Cost Accounting (and the operation of Perpetual Inventories) is to ascertain the profit by means of Sales and Cost of Sales Accounts. The entry to relieve the Finished Goods A/c. would be:—

Cost of Sales A/c. Dr. £3 18 0
To Finished Goods A/c. Cr. £3 18 0

If these goods were sold at £5/-/-, the entry would be:—

Sundry Debtors Dr. £5 0 0
To Sales Cr. £5 0 0

The gross profit on this transaction would therefore be £1/2/-, which is the difference between:—

Sales A/c., Credit Balance £5 0 0
and
Cost of Sales A/c., Debit Balance £3 18 0

Obviously this refers only to one transaction, but the principle is the same, no matter how many transactions are involved—the difference between Sales A/c. and Cost of Sales A/c. should represent Gross Profit.

Other Transfers.

Transfers from Goods in Process can cover other factors as well as goods for sales, e.g.,

1. *Machinery and Equipment for Plant.*

When machinery is built in the organisation's own workshop for its own use, it is transferred to Plant A/c. upon completion.

Plant and Machinery A/c. Dr.
To Work in Process A/c. Cr.

2. *Repairs.*

These are generally covered by Repair Orders, and upon completion are transferred from Work in Process. They really represent an addition to Factory Service Costs and would be treated in this manner.

Manufacturing Expense, Dept. 1 Dr.
To Work in Process A/c. Cr.

3. *Patterns, Jigs and Dies.*

When Dies and Patterns last many years and the quality of articles to be made from them is indefinite, their capital cost may be recovered on the Cost Sheets in the following manner:—

1. In a ledger for the purpose a separate account should be kept of each Die or Pattern.
2. These accounts would show the Capital Cost, whether the Dies and Patterns were bought from outside suppliers or made on the premises.
3. The Engineers' Department may estimate the probable working life of the Dies, though this may be difficult to do.
4. At the same time the Sales Department may be asked to supply some figure of the prospective sales.
5. If reasonably conservative figures can be given, they may be used to calculate a unit cost to apply to the Cost Sheets for the purpose of writing off the Dies or Patterns over their working life in accordance with the number of units that are likely to be sold.
6. In the General Ledger a Reserve for Depreciation should be created to write off the Capital Cost over the estimated working life of each Die or Pattern.
7. This Account will also appear in the Factory Ledger, and the debit for Depreciation will each month be credited with the allowances for Dies and Patterns appearing on the Cost Sheets for the volume completed in the factory. The total of the allowances for the month or period will be obtained from a column of the Finished Work Analysis.

These should be treated in the same way as Plant, except that Patterns, Jigs A/c. would be debited, the credit still going to Work in Process A/c.

4. *Defective Work.*

Defective Work may be accounted for:—

Firstly—

(a) By issuing additional material and charging it to "Defective Work" A/c. in the Factory Ledger.
(b) By charging the additional labour correcting it to the same account.
(c) By charging this account with the Manufacturing Expense lost.

(d) Only that portion of this account that has been budgeted should be included in the Manufacturing Expense rates or percentages of the Department.

(e) The balance should be transferred to the debit or credit of the Manufacturing Report prepared from the Factory Ledger.

Secondly—

(a) By separating First quality products from "Seconds."

(b) Then charging "Seconds" to a special account in the Factory Ledger at their manufactured cost.

(c) Crediting this "Seconds" account with their lower "sales value" when they are transferred to the Warehouse.

Thirdly—

Where work is spoiled, no matter from what cause, it must obviously be taken from the Work in Process A/c., and on account of its nature it becomes part of Factory Expense.

Manufacturing Expense	Dr.	
To Work in Process A/c.		Cr.

Where separate work in process accounts are opened for Raw Materials, Labour and Expense, the credit would go to each of these accounts in the proportion they had contributed. For example, if a job had been spoiled, and the material involved had cost £20, labour totalling £10 had been carried out on it, and £10 had been appropriated to cover the proportion of manufacturing expense applicable, separate Work in Process A/c. being kept to cover each element, the entry would be:—

Manufacturing Expense A/c.	Dr.	£40		
To Materials in Process A/c.			Cr.	£20
Labour in Process A/c.				10
Expense in Process A/c.				10

Control Over Warehouse Sections.

Where separate warehouses are used, and it is desired to exercise control over the stocks in each, separate accounts should be opened in relation to each and transfers made accordingly, e.g.:—

Finished Goods, Warehouse No. 1.	Dr.	£100		
„ „ „ „ 2.	Dr.	200		
„ „ „ „ 3.	Dr.	300		
To Work in Process A/c.			Cr.	£600

Part Finished Stocks.

These are kept in practically the same manner as for Raw Materials or Finished Stocks.

The Part-Finished Stock Accounts are debited with:—

1. The total amount of the Part-Finished Stock on hand at the beginning of the period.
2. The total cost of the Part-Finished Stock completed and transferred to the storerooms, as shown by production returns, the credit going to Work in Process A/c.

3. The total cost of such items as may be returned to the storerooms from the operating departments or from customers.

The Part-Finished Stock Accounts would be credited with:—

1. The total cost of the Part-Finished Stock which is transferred to the operating departments for use in the manufacture of the completed articles.
2. The total cost of Part-Finished Stocks sold.

CHAPTER 11.

COST AND GENERAL LEDGERS.

It now becomes necessary to examine the methods adopted and the relationship existing between the Cost Ledger and the General Ledger. The types of relationship existing between these two ledgers vary very considerably in different businesses. In brief, however, the types can be classified as:—

1. No direct relationship. The Cost Records would consist of a disconnected series of estimates prepared independently of, and without regard to, the financial accounts.
2. All Cost Data recorded in the General Ledger, but in terms such as to make possible, and indeed facilitate, the preparation of necessary cost statements.
3. Two sets of independent records, but capable of reconciliation if the costs and expenses are similarly classified in both sets.
4. Two sets of records, those in the Cost Ledger balancing with and being controlled by those in the General Ledger.

TYPES OF COST CONTROL.

These can be examined under three headings:—

1. No Direct Relationship Between Cost and Ledger Records.

All kinds of Cost Records and statements may be prepared without any attempt being made to incorporate the results in cost or General Ledgers. In such cases, estimates and statements of Actual Costs are prepared, but they are not reconciled with Ledger Accounts, and there is, therefore, not even presumptive proof of accuracy. Cost systems which are not co-ordinated with the financial accounts are untrustworthy and frequently misleading. Very often considerable work is necessary to ensure the results being of any value at all, and sometimes very little more work would be necessary to include the results in the books of account, thus obtaining a real guide as to accuracy. Statements of this kind are the natural method of setting forth such factors as differential cost and other schedules of comparative costs.

2. Both Cost and Financial Accounts Kept in the General Ledger.

Cost Accounts of this nature necessitate not only the preparation of a Cost of Sales Account, but also of those other accounts in relation to the control of Materials, Labour and Expense without which the cost of Sales cannot be prepared. In most cases, stock is divided into three natural divisions, and a control account is opened for each in the General Ledger, viz.:—

Raw Materials Account,
Work in Process Account.
Finished Stock Account.

Raw Materials Account is debited with the value of the opening stock and purchases during the period, and credited with withdrawals for manufacturing or other purposes. Work in Process is debited with:—

1. The value of work in process at the beginning of the period, as recorded on the uncompleted cost sheets.
2. The materials charges representing materials put into production and credited to Raw Materials A/c.
3. The charges for current productive labour.
4. The total factory expense of the operating departments.

It is credited with the cost of the articles manufactured and transferred to Finished Stock. This latter account is debited with the cost of the articles manufactured and taken into stock, and credited with the cost of sales made during the period. These accounts take the place of such accounts as Stock on Hand, Purchases, etc., ordinarily found in a General Ledger or Voucher Register under general accounting.

After the manufacturing departments have been charged through Work in Process Accounts with the various items of Materials, Labour and Expense, provision must be made for recording the production of these Departments. Production Reports showing the articles manufactured are therefore summarised so as to furnish the total cost of production. Costs of various items made during the period are compiled through the various Cost Sheets, and finished goods are transferred from the Work in Process Accounts to Finished Goods Accounts. Costs of all items sold, therefore, are known, and it is not difficult to compile a Cost of Sales A/c. The entry would cover a debit to Cost of Sales and a credit to Finished Stock.

This is very often the simplest method of controlling the Cost Records, as the Factory Controlling Accounts themselves become a part of the financial system. The various accounts necessary for the interpretation of costing procedure, operations and results are included in the General Ledger.

In closing the Ledger Accounts at the end of the period, the Cost of Goods Sold is transferred to the Trading Account, while the balances of Raw Materials, Goods in Process, and Finished Goods appear in the Balance Sheet. The balances of these accounts represent goods on hand, and need only be ruled off and brought down. Sometimes, however, there are discrepancies between the Book Value of stocks and the results disclosed by Physical Stocktaking. In such cases the Book Value has to be brought into line with the Actual Stocktaking. In the case of Raw Materials and Goods in Process, the value of differences can be transferred to a Manufacturing Cost Adjustment A/c. With Finished Goods, a Stock Adjustment A/c. can be opened and differences transferred to this account. The balance of the Manufacturing Cost Adjustment A/c. (either debit or credit) can be transferred to the Trading Account, being treated as a modification of the book value of the Cost of Sales. The difference disclosed in the Stock Adjustment A/c. can be treated as representing a distribution expense, and will appear in the Profit & Loss A/c. accordingly.

If there are any differences in the Labour A/c. (which may occur where labour charges are made on the basis of estimates, or where idle time does not allow an amount to be charged directly against any product) this amount can also be charged to the Manufacturing Cost Adjustment A/c. In the case of Factory Service, where predetermined rates are in operation, expense will be either over-absorbed or under-absorbed, and balances will be transferred to "Over-absorbed Factory Expense A/c." or "Under-absorbed Factory Expense A/c." These amounts can then be transferred to the Manufacturing Cost Adjustment A/c., and from there they find their way into the Trading or Profit & Loss A/c.

3. Separate Cost and General Ledgers are Kept.

This method is generally in operation where the organisation is large and operations involved, or where the factory is some distance from the General Office and detailed records are necessary at the factory. All items appearing in the Factory Ledger—that is, all items affecting manufacturing costs—are controlled through the General Ledger through one account, generally termed "Factory Ledger Control A/c."

General Ledger Entries.

The Factory Ledger Control A/c. in the General Ledger is debited with—

1. Stock on Hand at the beginning of the period, as disclosed by the Stock Sheets.
2. Total amount of Materials purchases, as disclosed by the Purchase and other Journals.
3. Total amount of. Salaries and Wages paid for productive or non-productive factory labour.
4. Total amount of Factory Expenses, as shown by the various records, such as Purchase Journal, Wages Sheets, General Journals, etc.

The Factory Ledger Control A/c. in the General Ledger is credited with—

1. Total cost of sales.
2. Total cost of work done by the Factory, chargeable against selling or administrative expense.

Factory Ledger Entries.

A corresponding account, the "General Ledger Control A/c.", is opened in the Factory Ledger.

In the Factory Ledger, accounts are usually divided into classifications of:—

1. Raw Material Accounts.
2. Work in Process Accounts.
3. Part-Finished Stock Accounts.
4. Finished Stock Accounts.
5. Labour Accounts.
6. Factory Indirect Expense Accounts.

There is complete balancing between Financial and Cost Accounts.

Raw Materials Accounts.

One of several Raw Materials Accounts may control the items of Direct Materials and Supplies classified in the Stores Ledger either by kinds or by location. The number of accounts and storerooms will obviously depend upon the requirements in each case. The method of posting the transactions to several Raw Materials Accounts is the same as the method of posting to one account, except that additional entries may be necessary to record stock transfers between storerooms. The Raw Materials Accounts are debited with:—

1. The amount of stock on hand at the beginning of the period.
2. The total amount of raw material purchased, as per Purchase or General Journals. Returns must, of course, be taken into account.
3. Stock transfers during the period.

The Raw Materials Accounts are credited with:—

1. Total amount of materials issued from stock, as shown by the summaries of materials requisitions. Materials returned to the stores are deductions from amount requisitioned.
2. Stock transfers during the period.

Work in Process Accounts.

These accounts control the Cost Sheets of either the jobs, orders, or articles in course of manufacture, or the various processes through which the products pass. These accounts may be kept in four different ways:

1. One account may control all work in process.
2. Separate accounts may control each element of expense.
3. Separate accounts may control each operating department.
4. Separate accounts may control each job or factory order issued, or each process or each machine.

Where both special and standard products are manufactured, it is helpful to keep Work in Process Accounts separately, if this is practicable. The advantages of keeping several Work in Process Accounts in place of one Controlling Account are:—

1. Discrepancies are more easily noted.
2. A test of the stock value of Work in Process is more easily made.
3. If it is necessary to adjust discrepancies in the cost of Work in Process, due to unlocated differences, several accounts provide more satisfactory means of making the necessary corrections. Adjustments can then be made in the one account without affecting the others.

The method of keeping Work in Process Accounts is practically the same for one or several accounts. The accounts are debited with:—

1. The Cost Value of the work in process on hand at the beginning of the period.
2. The Direct Material received from stores, as shown by the summary of material requisitions after deducting materials returned to stores.
3. The Direct Labour for the period, as disclosed by the Wages Sheets.
4. The total of Factory Expenses, as shown by the various records.

The accounts are credited with:—

1. The Material Labour and Overhead Costs of the production transferred to Finished Stocks, Part-Finished Stocks, or Raw Materials Stock Accounts.

2. The total Material, Labour, and Overhead costs of any Machinery, Tools or other equipment which has been manufactured for the use of the plant, and is to be capitalized accordingly.
3. The total Material, Labour and Overhead costs of Maintenance and Repairs which have been absorbed in the Factory Overhead.
4. The total Material, Labour and Overhead Costs of the Maintenance and Repairs which are absorbed in the Selling and Administrative Expense Accounts.

Adjusting entries to cover discrepancies in the cost of work in process would also be debited or credited to the work in process accounts.

Postings to Part-Finished Stock accounts and to Finished Stock accounts have already been shown in the previous chapter.

In the Factory Ledger, a General Ledger Account is opened when it is desired to make the Factory Ledger self-balancing. This account is the reverse of the Factory Ledger Account in the General Ledger and is credited with:—

1. The total amount of the various Raw Materials, Work in Process, Part-Finished and Finished Stock totals at the beginning of the period.
2. The total amount of the Merchandise and Supplies purchased during the Cost Period—the Raw Materials Accounts being debited.
3. The total amount of productive and non-productive Wages incurred in connection with factory operations, the Direct Labour, Factory Expense or Work in Process Accounts being debited.
4. The total amount of Factory Expense for the period, the various detailed Factory Expense Accounts being debited.
5. The total amount of Merchandise returned during the period, the offsetting entries being the debits to the various Finished Stock or Part-Finished Stock Accounts.

The General Ledger Account in the Factory Ledger is debited with:—

1. The total cost of Sales, as shown by the summary of Cost of Sales—at the time the Finished Stock or Part-Finished Stock Accounts are credited.
2. The total cost of Machinery, Tools or miscellaneous equipment, as shown by the Production Summary—at the time the various Work in Process Accounts are credited.
3. The total cost of Repairs and cost of miscellaneous Supplies transferred to the Selling or Administrative Departments of the business—at the time the various Work in Process Accounts and Raw Materials Accounts are credited. This information would be shown upon the Production Summaries and the Materials Requisition Summaries.

The balance of the General Ledger Account is virtually always a credit, and is in agreement with the debit balance of the Factory Ledger Account in the General Ledger. Selling and administration costs would appear in the General Ledger and not in the Cost or Factory Ledger.

Example of Cost Ledger Entries.

The A.B.C. Manufacturing Company operates a factory situated some miles from the Head Office. All sales are despatched from the factory, but all invoicing is carried out by the Head Office.

Whilst no Cost Accounts have been kept previously, a commencement is to be made and a Cost System installed. This will provide for Factory, Work in Process, and Stores Ledgers at the factory. The factory ledger is to contain an account for Payroll Cash and one for Accrued Payroll, kept in such a way that the former will show unclaimed payroll cash on hand; the latter the liability for unclaimed wages.

The Trial Balance of their Books at 1st July, 194—, shows:—

Cash	£1,135	
Sundry Debtors	9,747	
Bills Receivable	1,788	
Factory Plant and Machinery	5,156	
Small Tool and Supplies	752	
Office Buildings	1,000	
Factory Buildings	9,396	
Finished Goods	5,152	
Work in Process	3,398	
Raw Materials	2,576	
Factory Petty Cash	160	
Bills Payable		£2,552
Sundry Creditors		3,124
Capital		30,000
Reserves		4,584
	£40,260	£40,260

During the month of July, the following transactions occurred:—

Factory Wages paid, £3,360. Unclaimed Wages totalled £95, still held at the factory until called for. Of the total amount of labour, £2,516 is Direct Labour, and the balance Indirect.

Materials purchased and received for use in factory work amounted to £4,851; requisitions on the storekeeper for materials used in manufacture amounted to £3,647; requisitions for materials used in repairs to machinery, etc., amounted to £151; requisitions for small tools and supplies amounted to £79.

Special jobs completed and delivered cost to make £5,676; stock orders completed amounted to £1,078; cost of sales of finished goods from stock amounted to £1,468.

Factory Expenses for insurance, water, rents, taxes, etc., amounted to £779; depreciation on machinery is to be taken care of by setting up a reserve at the rate of 12% per annum. It is proposed to show:—

(a) Journal entry for general books to open Factory Ledger.

(b) Entries in Factory books; to open, to record transactions of July, and to close Factory Ledger.

(c) An abstract of all Factory Ledger Accounts, including General Ledger Control A/c., as they should appear after the entries for July have been made.

(d) Trial Balance of Factory Ledger as at July 31st.

(e) Abstract of Factory Ledger Control A/c.

The following would be the Journal entries in the General Ledger to open the Factory Ledger:—

Factory Ledger Control A/c.	Dr.	£12,038		
To Small Tools and Supplies			Cr.	£752
Finished Goods			„	5,152
Work in Process			„	3,398
Raw Materials			„	2,576
Factory Petty Cash Fund			„	160

(To close Factory Ledger Accounts for Opening Factory Ledger.)

The entries necessary to open the Factory Ledger would be:—

(1)

Small Tools and Supplies	Dr.	£752		
Finished Goods	„	5,152		
Work in Process	„	3,398		
Raw Materials	„	2,576		
Factory Petty Cash Fund	„	160		
To General Ledger Control A/c.			Cr.	£12,038

(To set up opening balances on Factory Ledger.)

(2)

Work in Process	Dr.	£2,516		
Factory Expense	„	939		
To Accrued Wages			Cr.	£3,455

(To charge accrued wages to production.)

(3)

Payroll Cash	Dr.	£3,455		
To General Ledger Control A/c.			Cr.	£3,455

(To record receipt of payroll cash from general office.)

(4)

Accrued Wages	Dr.	£3,360		
To Payroll Cash			Cr.	£3,360

(To record payment of wages claimed.)

(5)

Raw Materials	Dr.	£4,851		
To General Ledger Control A/c.			Cr.	£4,851

(To record purchase of Materials.)

(6)

Work in Process	Dr.	£3,647		
Factory Expense	„	230		
To Small Tools and Supplies			Cr.	79
Raw Materials			„	£3,798

(To record summary of requisitions for month as follows:—

Direct Materials	£3,647
Repair Materials	151
Small Tools and Supplies)	79
	£3,877

(7)

Factory Expense	Dr. £831	
To General Ledger Control A/c.		Cr. £831

(To charge Factory Expense account as follows:

Insurance, Water, Taxes	£779
Depreciation)	52
Total	£831

(8)

To Work in Process	Dr. £2,000	
To Factory Expense		Cr. £2,000

(To close Factory Expense account to work in process.)

(9)

General Ledger Control	Dr. £5,676	
To Work in Process		Cr. £5,676

(To charge General Ledger Control account for cost of special orders completed and shipped.)

(10)

Finished Goods	Dr. £1,078	
To Work in Process		Cr. £1,078

(To charge Finished Goods account for cost of stock.)

(11)

General Ledger Control	Dr. £1,468	
To Finished Goods		Cr. £1,468

(To charge General Ledger Control for cost of goods sold from stock.)

The following would be the various Factory Ledger Accounts after the posting of July transactions.

FACTORY PETTY CASH.

Balance	(1)	£160			

PAYROLL CASH.

Cash Received	(3)	£3,455	Claimed	(4)	£3,360
			Balance		95
		£3,455			£3,455
Balance		£95			

RAW MATERIALS.

Opening Stock	(1)	£2,576	Used	(6)	£3,798
Purchases	(5)	4,851	Balance		3,629
		£7,427			£7,427
Stock		£3,629			

WORK IN PROCESS.

Opening Stock	(1)	£3,398	Special—Completed	(9)	£5,676
Wages	(2)	2,516	Stock Completed	(10)	1,078
Materials	(6)	3,647	Balance		4,807
Factory Expense	(8)	2,000			
		£11,561			£11,561
Stock		£4,807			

FINISHED GOODS.

Opening Stock	(1)	£5,152	Stock Sold	(11)	£1,468
Stock Finished	(10)	1,078	Balance		4,762
		£6,230			£6,230
Balance		£4,762			

SMALL TOOLS AND SUPPLIES.

Opening Stock	(1)	£752	Used	(6)	£79
			Balance		673
		£752			£752
Stock		£673			

FACTORY EXPENSE.

Wages	(2)	£939	To Work in Process	(8)	£2,000
Repair Material	(6)	151			
Small Tools and Supplies	(6)	79			
Insurance, etc.	(7)	779			
Depreciation	(7)	52			
		£2,000			£2,000

ACCRUED WAGES.

Paid	(4)	£3,360	Earned	(2)	£3,455
Balance		95			
		£3,455			£3,455
			Balance		£95

GENERAL LEDGER CONTROL.

Cost—Special Orders	(9)	£5,676	Balance	(1)	£12,038
Cost—Stock Sales	(10)	1,468	Payroll Cash	(3)	3,455
Balance		14,031	Materials	(5)	4,851
			Water, Depreciation, Insurance, Taxes	(7)	831
		£21,175			£21,175
			Balance		£14,031

FACTORY LEDGER.

Trial Balance.

June 30, 19—

Factory Petty Cash	£160	
Payroll Cash	95	
Raw Materials	3,629	
Work in Process	4,807	
Finished Goods	4,762	
Small Tools and Supplies	673	
Accrued Wages		£95
General Ledger Control		14,031
	£14,126	£14,126

The Factory Ledger Control A/c. in the General Ledger would be:—

FACTORY LEDGER CONTROL.

To Opening Balance	£12,038	Cost of Sales—Special	£5,676
Payroll	3,455	Cost of Sales—Stock	1,468
Materials	4,851	Balance	14,031
Water, Depreciation, Insurance, Taxes	831		
	£21,175		£21,175

CHAPTER 12.

MARKETING AND ADMINISTRATION COSTS.

The methods outlined in foregoing pages have been designed to arrive at the cost of making the product. In order to arrive at Net Profit, it is necessary to take into account Selling, Distribution and Administration Expenses.

Many treatments of Cost Accounting practically confine attention to the Cost to Make, and in many organisations Manufacturing Costs are zealously prepared but little or no note is taken of selling or administration costs.

> "One of the most remarkable and possibly disturbing factors in the development of business over the last decade has been the abnormal increase in marketing costs. These comprise those expenses which are incurred in getting the finished product from the warehouse floor to the buyer, including Advertising, Selling Expenses, and frequently the costs of invoicing and collection of accounts. The increases can be traced to the following causes:—
>
> 1. The common desire for increased turnover resulting in the extension of selling operations into areas where volume is small.
> 2. The introduction of more hand-to-mouth buying, with consequent reduction in the average size of orders and increased sales visits and handling charges.
> 3. The growth of competition which has resulted in the granting of additional benefits under the guise of service.
>
> The problem of marketing costs became more serious as falls in turnover became more general. Rising sales volumes largely hid the extra expenses, but when the position was reversed the growth in costs of securing orders often became almost startlingly apparent.
>
> It is remarkable that so little attention has been paid to the investigation and interpretation of these expenses. It is common to find businesses which are extremely careful in the matter of production costs, going to long lengths to secure efficiency, yet devoting no attention to Selling Costs."
>
> (Scott, "Business Budgeting and Budgetary Control.")

Of late there is a pronounced tendency to devote increased attention to selling and administrative expenses, partly because these costs have grown to such an extent during the last decade. In many industries, the question is not whether service should be given, but just how much service.

Any examination of these factors can be pursued under the following headings :—

1. What constitutes marketing and administrative expense?
2. For what purposes and how may they be analysed?
3. What accounting treatment is necessary to record them?

MARKETING COSTS.

Classification of Expenditures.

Marketing Expense can be interpreted as including (i) Selling Expense, (ii) Distribution Expense, (iii) Warehouse Expense.

For general purposes these can be considered together. The first relates to costs involved in selling the products or in furthering sales. The second covers costs incurred in the transfer of goods from the factory or warehouse to their ultimate destination as demanded by the customer. The third, Warehouse expense, covers cost of storage and warehousing of the finished product.

The following would be a more comprehensive list :—

1. Direct selling expense.
2. Advertising and sales promotional expense.
3. Warehousing and handling expense.
4. Transportation expense.
5. General distribution expense.
6. Financial expenses, including credit and collection.

The following could appear in a classification of marketing expense:—

701 to 750 Selling Expense,

701	Salaries—Executive,
702	Salaries—Salesmen,
703	Salaries—Clerical,
704	Commission—Executive,
705	Commission—Salesmen,
706	Commission—General,
707	Travelling Expenses—Executive,
708	Travelling Expenses—Salesmen,
709	Travelling Expenses—General,
710	Entertainment Expenses—Executive,
711	Entertainment Expenses—Salesmen,
712	Advertising—Newspaper,
713	Advertising—Radio,
714	Advertising—Catalogues,
715	Advertising—Samples,
716	Advertising—Sundries,
717	Printing and Stationery,
718	Postages and Telegrams,
719	Telephones—Executive,
720	Telephones—Salesmen,
721	Telephones—Clerical,
722	Insurance—Workers' Compensation,
723	Insurance—General,
724	Rates and Taxes,
725	Heat, Lighting and Power,
726	Depreciation—Building,
727	Depreciation—Fixtures,
728	Motor Car Expenses—Executive,
729	Motor Car Expenses—Salesmen,
730	Motor Car Expenses—General,
731	Rent,
732	Donations,

751 to 800 Distribution Expense,

751	Salaries — Supervision,
752	Salaries—Clerical,
753	Wages—Truck Drivers.
754	Wages—Garage,
755	Motor Trucks—Petrol and Oil,
756	Motor Trucks—Repairs and Maintenance,
757	Motor Trucks—Licences,
758	Motor Trucks—Depreciation,
759	Motor Trucks—Other Supplies, and Expenses,
760	Printing and Stationery,
761	Postages and Telegrams,
762	Telephones,
763	Insurance—Motor Trucks,
764	Insurance—Workers' Compensation,
765	Insurance—General,
766	Rates and Taxes,
767	Depreciation—Building,
768	Depreciation—Fixtures,

801 to 850 Credit and Collection,

801	Salaries—Supervision,
802	Salaries—Clerical,
803	Bad Debts,
804	Legal Expenses,
805	Travelling Expenses,
806	Insurance — Workers' Compensation,
807	Insurance—General,
808	Rates and Taxes,
809	Rent,
810	Postages and Telegrams,
811	Telephones,
812	Office Supplies.

Warehouse and Financial Expenses could also be included in a separate minor classification.

Purposes of Analysis.

Whilst expenses would naturally be classified under accounting headings, they do not thereby give maximum information to enable management to obtain efficiency. Amongst the questions which management may ask would be the following:—

1. What commodities should be sold?
2. What prices should be charged?
3. Where should commodities be sold?
4. What methods of trading should be adopted?
5. What orders (sizes) would be profitable?
6. What stocks should be carried?
7. What lines warrant special treatment (credit, advertising, etc.)?
8. What are the most profitable selling areas?
9. What are the most profitable selling methods?
10. What are the most profitable delivery methods?
11. Who are the most profitable salesmen?
12. Does it pay to distribute through wholesalers, or direct to the public?

All these questions necessitate an analysis of marketing expense. Obviously, some of them at least, are also bound up with an examination of the Cost to Make.

Any analysis of distribution expense will generally show that:—

1. Some expenses are incurred for a particular order.
   These can, where desired, be charged direct to the order.
2. Some expenses are incurred in connection with a particular product, but cannot be allocated definitely to each order.
   These must be applied in some general way to the particular product, and thence to orders.
3. Some expenses are general in character. These form by far the largest amount of Marketing expense; and even more so of Administration expense.

   They must be applied to each product in some general way, and then re-applied to individual orders.

The simplest form of allocation is to be found in an apportionment of expense on a Turnover basis, to, say, the three or four products made in a business. For example, a Company may produce:—

4,000 of "A" product	at £1 ea.	.. ..	£4,000
2,000 of "B" „	„ £2 „	.. ..	£4,000
1,000 of "C" „	„ £2 „	.. ..	£2,000
4,000 of "D" „	„ 10/- „	.. ..	£2,000
			£12,000

Distribution Expense may amount to £3,000. On a turnover basis, the distribution would be as under:—

"A"	£1,000
"B"	1,000
"C"	500
"D"	500
	£3,000

If this expense was interpreted in terms of numbers of units, it would mean that the cost per unit was "A" 5/-, "B" 10/-, "C" 10/-, "D" 2/6.

On the other hand, it may be decided to spread the whole of the Marketing expense on a unit basis. This would mean the distribution of £3,000 amongst 11,000 units—a basis of 5/5$\frac{5}{11}$ per unit. From the foregoing, the cost of any order could be worked out—for example, if Order No. 1 consisted of 50 of "A", 40 of "B", 20 of "C", 50 of "D", the cost of the order would be (under the first method) £48/15/-, and under the second £43/12/9.

An apportionment of the whole of the marketing expense on a turnover basis does not usually give an accurate result. For example, in the illustration given above, each of the products may not have attracted expense equally. In the case of Salesmen's Salaries, for example, it may be capable of proof that Product "A" requires much more time and attention on the part of salesmen than Product "B", and should therefore bear a greater proportion of the expense. To obtain accuracy in apportionment, therefore, it is necessary to undertake a detailed examination of each expense classification. The method of allocation, however, will depend upon the information desired. If an attempt is made to ascertain the cost of selling all products in various geographical areas, the apportionment may be made on a different basis from that which would operate where the desire is to obtain the costs of the various methods of selling.

Methods of Analysis.

Distribution costs could be analysed by:—

1. Geographical areas.
2. Sizes of orders.
3. Commodities.
4. Methods of sale.
5. Methods of delivery.
6. Salesmen.
7. Organisation and operating divisions.
8. Units.

The following table sets out the apportionment of various marketing expenses in relation to some of the basic analyses desired. The symbols are:—

D—Apportionment made direct in the case of the analysis shown.

P—Apportionment made partly as direct and partly a general distribution.

C—Apportionment made only by a general distribution.

It will be seen that some expenses capable of direct apportionment in one analysis must be spread on a general basis to other analyses.

FIGURE No. 58.

APPORTIONMENT BASES FOR DISTRIBUTION EXPENSES.

	Geographical	Sizes of orders	Commodities	Methods of sales	Methods of delvy.	Salesmen	Orgn. and Optg. Divs.	Units
Advertising—								
Executive Sals.	P G	G	P G	P G	G	G	P G	G
Newspaper Advt.	P G	G	P G	P G	G	P G	P G	G
Radio Advert.	P G	G	P G	P G	G	P G	P G	G
Product Advt.	G	G	D	P G	G	G	P G	G
Accounting, Recording, etc.—including—								
Invoicing,								
Order Handling,								
Sales Records,								
Statistics, etc.	P G	G	G	P G	P G	P G	P G	G
Branch Office Exs.	D	G	P G	P G	G	P G	D	G
Gen. Sales Office Ex.	P G	G	G	G	G	G	G	G
Entertainment Exs.	P G	G	P G	P G	G	P G	P G	G
Delivery Exs.	D	G	P G	P G	D	P G	P G	G
Containers	P G	P G	P G	G	P G	G	G	G
Freight Outwards	D	P G	D	P G	D	P G	P	
Commissions	D	P G	D	D	D	D	D	
Salaries—Salesmen	D	G	G	D	G	D	D	
Trav. Exs.— ,,	D	G	G	D	G	D	D	
Rent, Rates & Taxes	D	G	G	G	G	G	P G	
Research & Develop.	G	G	G	G	G	G	G	
Marketing Research	D G	G	P G	P G	P G	G	G	
Bad Debts	D	G	P G	D	D	D	D	
Credit & Collectn.	P G	G	G	G	G	D	P G	
Deprec.—Office Machines	G	G	G	G	G	G	G	
Insurance—Fire	G	G	G	G	G	G	G	
Legal Expenses	P	G	P G	P	G	P	P	
Printing & Stat.	P	G	G	G	G	G	P G	
Tel. Postages, etc.	P	G	G	P G	G	P	P G	
Shipping Charges	D	P G	P G	D	D	D	P	
Warehouse Exs.	P	G	G	G	G	G	P G	

The above apportionments are indicative only as they vary greatly between individual expenses. What is general in one business may be direct in another.

It is now proposed to examine some of the basic analyses with a view to showing the method of procedure to be adopted.

1. Geographical Areas.

The following steps would be involved:—

(i) Divide all expenses into Direct, Semi-direct, and Indirect.
(It should be noted that the term "Direct" is used as referring direct to a particular territory.)

(ii) Apportion the Direct Expenses to the territories affected.

(iii) Apportion the Semi-direct Expenses to the territories on an acceptable basis.

(iv) Apportion the Indirect Expenses to the territories on an acceptable basis.

(See Figure No. 59).

FIGURE No. 59.

APPORTIONMENT TO TERRITORIES.

		TERRITORIES.			
	Total	"A"	"B"	"C"	"D"
Gross Profit					
Less Selling Expense—					
Direct					
Salaries—Salesmen,					
Travelling Expenses—Salesmen,					
Telephone—Salesmen,					
Motor Car Exs.—Salesmen,					
Commission—Salesmen,					
Advertising—Newspaper					
Radio,					
Catalogues,					
Samples,					
Bad Debts,					
Semi-Direct,					
(Apportionment Basis—Sales Value).					
Salaries—Executive,					
Clerical,					
Commission—Executive,					
Others,					
Trav. Exs.—Executive,					
Clerical,					
Entertainment—Executive,					
Advertising—					
Telephones—Executive,					
Clerical,					
Insurance—Workers Compensation,					
General,					
Indirect.					
(Apportionment Basis—Building Space)					
Rates and Taxes,					
Lighting and Heating,					
Depreciation—Building,					
Fixtures,					
Rent,					
(Apportionment Basis—Sales Value),					
Donations,					
Legal Expenses,					
Credit and Collection Exs.					
Postages and Telegrams,					
Office Supplies.					

By an analysis of Distribution costs in the foregoing way, it may be possible to prepare statements similar to those shown in Figures Nos. 60 and 61.

FIGURE No. 60.

SELLING COSTS BY TERRITORIES.

Districts	% of Total of Gross Sales Yielded	% of Total Direct Sales Expenses	% of Total Customers in Territory	Budget % Ratio of Exp. to Sales Territory	Actual % Ratio of Exp. to Sales Territory
“A”	39.6	24.6	28.6	1.00	.86
“B”	23.8	27.2	31.2	1.00	.87
“C”	17.9	19.8	18.4	1.00	1.08
“D”	12.4	12.9	12.2	1.00	1.06
“E”	3.2	4.1	4.1	1.00	1.00
“F”	3.1	11.4	5.5	2.00	2.07

FIGURE No. 61.

EXPENSES BY TERRITORIES.

Districts	Direct Selling Cost per £ of Sales	Number of Salesmen
“A”	3.134d.	3
“B”	4.216d.	2
“C”	4.384d.	2
“D”	2.814d.	2
“E”	7.163d.	3
“F”	11.465d.	3

As a result of the figures disclosed in Figure No. 61, a further analysis of the expenses in Districts “E” and “F” may be called for. This may point to the advisability of taking a traveller off “F” Territory and trying to develop “D” more strongly.

2. Sizes of Orders.

The following procedure could be adopted to arrive at the requisite information which would enable a study of the costs of orders of varying sizes, and the implications behind such.

(i) Determine the size of Order Groups which it is proposed should be studied.

(ii) Classify costs according to

  (a) those varying directly with the size of an order (for example, packing),

  (b) those which are uniform for orders of any size (for example, accounting entries),

  (c) those which bear no direct relationship to sizes of orders, and which are therefore treated as general overhead for example, rent),

(iii) Ascertain a suitable apportionment basis for the truly variable expenses. This may be done by experiment and example, such as a survey of packing costs in relation to various orders. It might be possible to distribute packing according to size, weight or even value.

(iv) The uniform costs should also be spread upon a suitable basis (which might be quite different from that adopted to spread the direct expense). The cost of clerical work might, for example, be spread over the number of various orders, irrespective of size.

(v) The general overhead costs must be spread upon the best basis obtainable, which may be weight, size, value or number.

After an analysis of expense similar to the foregoing, it may be possible to prepare statements similar to those shown in Figures Nos. 62, 63 & 64.

FIGURE No. 62.

CLASSIFICATION OF CUSTOMER CLASSES.

Size of Group Annual Sales	% of Total Nos. of Accounts	% of Total Volume of Business	% of Total Direct Selling Exps.
Over £5,000	1%	30%	3.4%
£3,500 to £5,000	13%	38%	11.6%
£2,000 to £3,500	19%	18%	18.1%
£1,000 to £2,000	31%	10%	29.6%
0 to £1,000	36%	4%	37.3%

FIGURE No. 63.

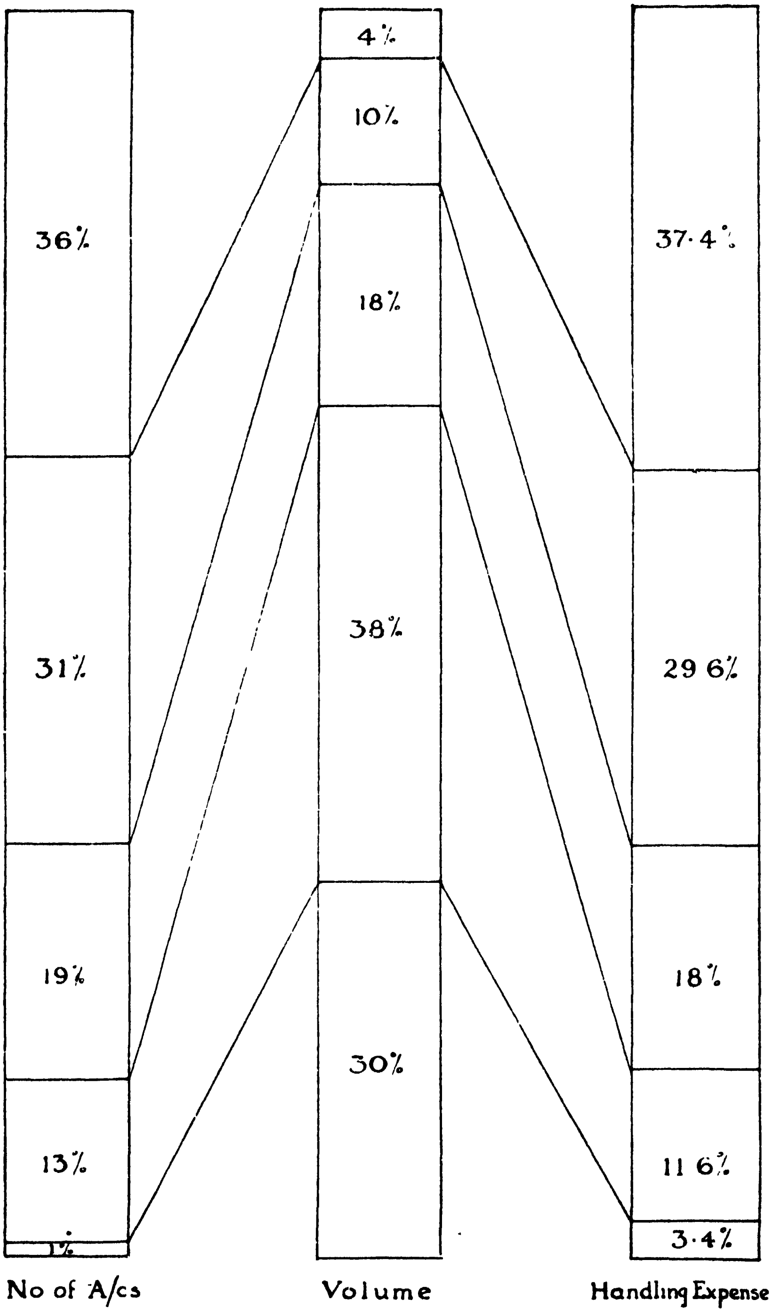
CLASSIFICATION BY CUSTOMER CLASSES.

ANALYSIS OF SALESMEN'S EXPENSES.

Sales-man	Sal. & Trav. Exs.	Total Sales	Ratio of Exs. to Sales	No. of A/cs.	Av. Value per A/c.	Large Accounts			Balance of Accounts		
						Total Sales		Sales per A/c.	Total Sales		Sales per A/c.
	£	£	%	No.	£	No.	£	£	No.	£	£
" A "	1,151	41,704	2.76	167	250	20	20,422	1021	147	21,282	145
" B "	1,485	48,377	3.07	68	711	13	30,265	2328	55	18,112	329
" C "	1,060	27,979	3.79	53	528	15	16,040	1069	38	11,939	314
" D "	1,744	39,116	4.46	52	752	9	23,087	2565	43	16,029	373
" E "	1,039	16,041	6.48	136	117	6	4,761	793	130	11,280	87
" F "	1,118	10,458	10.69	75	139	4	5,231	1308	71	5,227	74
" G "	1,195	10.450	11.44	70	149	6	6,310	1052	64	4,140	65
	£8,792	£194.125	4.53%	621	£313	73	£106,116	£1454	548	£88,009	£161

FIGURE No. 64.

AVERAGE PROFITABLENESS OF ORDERS HANDLED.



The cost of orders of various sizes is often a fruitful field for investigation, and frequently considerable savings can be made by the institution of a campaign to increase the size of orders. The high cost of the small order is often overlooked, but it can have a very serious effect upon Distribution expense. This is shown particularly by recent investigation into the relative expenses of two orders—one five times as large as the other. The following results were established :—

Office Costs.

The cost of recording the small order was 88% of that of the large order.

The cost of invoicing the small order was 82% of that of the large order.

The cost of granting credit for the small order was 97% of that of the large order.

The cost of collecting the account of the small order was 101% of that of the large order.

Handling Costs.

The cost of packing the small order was 54% of that of the large order.

The cost of trucking the small order was 52% of that of the large order.

The cost of shipping the small order was 56% of that of the large order.

Assuming that the large order was £20, then the small order would be £4. Supposing that the cost in connection with the large order of each of the items mentioned was 2/6, then the office costs would total 10/- and the handling costs 7/6. From the percentages just given, the costs of the small order would be:—

Office Costs.		**Handling Costs.**	
Recording	2/2	Packing	1/4
Invoicing	2/0½	Trucking	1/3½
Credit	2/5	Shipping	1/5
Collection	2/6		
	9/1½		4/0½

Therefore the work on the small order would cost about 75 per cent. of the work on the large order. The cost on the £20 order would be 17/6, which would be 4.375 per cent., whilst for five small orders—again, totalling £20—the cost would be £3/5/10, which would mean 16.45 per cent

3. Commodities.

An analysis of this nature really amounts to an extension of the cost of production into the distribution field. Very often one of the most valuable results from an appropriation of costs of this kind is in the information yielded regarding variations between products.

The method of treatment should be similar to that already outlined in relation to territories and methods of sale. Those costs which can be apportioned direct to various products should be treated in this fashion. Those expenses which have some relationship, but not a direct one, should be apportioned upon the best basis that can be obtained, and general items of expense spread in general fashion.

Analyses of this kind may show that where the Company manufactures four products, it may derive 75% of its sales from one product, and yet the other three may account for 75% of the distribution expense. Figure No. 65 sets forth a statement of Selling Costs by Commodities.

FIGURE No. 65.

SELLING COSTS BY COMMODITIES.

Product	Sales Volume	Selling Cost	Budget-Ratio Cost to Sales	Actual-Ratio Cost to Sales
	£	£	%	%
1.	110,000	2,651	2.35	2.41
2.	1,500	130	8.41	8.67
3.	15,000	513	3.51	3.42
4.	33,000	1,855	5.82	5.62
5.	3,400	1,062	30.41	31.24
6.	2,800	1,904	61.52	68.00

4. Methods of Sale.

Distribution expense can be analysed to show the cost of selling by Salaried Salesmen, by Commissioned Salesmen, by Direct Mail, by House to House canvas. Furthermore, differences in cost of city and country distribution can be shown. The methods of sale can briefly be set out as:

(a) Producer to Agent, to Wholesaler, to Retailer, to Customer.

(b) Producer to Wholesaler, to Retailer, to Customer.

(c) Producer to Retailer, to Customer.

(d) Producer to Customer.

5. Methods of Delivery.

A partial analysis of certain distribution expenses may be all that would be necessary to arrive at comparative costs of delivery by :—

1. Owned Vehicles.
2. Hired Vehicles,
3. Rail,
4. Boat, etc.

Of course, some expenses would have no bearing upon the point at issue and could be ignored. It may be possible to show that appreciable sums could be saved by the hire of transport to effect delivery, as against the use of a fleet of vehicles owned by the organisation, or vice versa.

6. Salesmen.

An analysis of this kind may be very valuable. It is now gradually being realised by management that the salesman with the biggest volume of sales may not necessarily be the most profitable. In order to arrive at a sound judgment, it may be necessary not only to examine the numbers of various products sold by each salesman and the factory cost of such products, but also the selling costs involved. If, for example, an analysis of results showed that Salesman "A" sold 5,000 units of a product, with selling expenses of 5/- per unit, and Salesman "B" sold 4,500 at a selling expense of 2/6, the latter may be the better performance. Judgments of this kind can only come from a study of costs which should include not only cost to manufacture, but cost to sell.

7. Organisation and Operating Divisions.

Sometimes it is desirable to make a division of expense into branches, departmental stores, agencies, direct canvas, etc. A procedure similar to that described above should be used to arrive at these figures.

8. Units.

In any analysis of costs similar to the foregoing it is often necessary to arrive at some unit base, and a list of these is given hereunder:—

(a) Cost per lb., cwt., ton, etc.
(b) Cost per order.
(c) Cost per product.
(d) Cost per hour.
(e) Cost per customer.
(f) Cost per item.
(g) Cost per space factor.
(h) Cost per £ of sales.

Accounting Treatment.

The various accounts covering marketing expenses are to be found in the General Ledger. Sometimes only three or four main accounts are kept, and a subsidiary ledger is used for the entry of details within each particular account. As a rule no apportionment is made from the various accounts to "Cost to Make and Sell" within the Financial books themselves. The various Distribution expenses are allowed to remain in the individual accounts and are simply transferred to the Profit and Loss A/c. at the end of the period. This is in accordance with the usual accounting treatment and has little relationship to cost accounting.

Very often, in such cases, the application of a proportion of marketing expense is made through the agency of Statistical Tables and Statements. An apportionment of expense applicable to a selected unit is calculated upon some acceptable apportionment basis. The results can provide very useful information, and a balance can be struck through the totals of such statements.

In earlier chapters it has been pointed out that apportionments of Manufacturing Expense is made to "Cost of Goods Sold" by the adoption of base rates. The methods outlined in connection with Manufacturing Expense can be applied to marketing expense. Any such arrangement pre-supposes, however, the preparation of a Marketing Expense Budget. This necessitates a thorough analysis of all items included in Marketing Expense and can be accomplished in a variety of ways.

It may be possible to arrive at the necessary estimates by a close investigation of each individual account included in marketing expense. The figures for previous periods would be inspected, trends would be noted, unusual conditions likely to operate in the new period would be determined, and after a thorough survey of such relevant factors, the expected amount of each account would be inserted in the budget. Alternatively, and particularly where changing conditions were likely, it may be necessary to arrange for various executives to prepare the expense budgets required.

The Budgets necessary to cover Marketing costs are :—

1. The Selling Expense Budget.
2. The Advertising Budget.
3. The Warehouse, Packing and Transportation Expense Budget.

1. *The Selling Expense Budget.*

This budget is often prepared by the Sales Manager, though in large organisations it may be delegated to his assistant. Sometimes it is compiled at the same time as the Sales Budget, whilst at others it is prepared after this latter has been completed. Frequently it is found that many of the records necessary for preparing the Selling Expense estimates must come from the Accounting Department. Indeed, in certain somewhat exceptional cases, the budget itself is prepared by the Accounting Department, though this practice is not recommended. Where the Assistant Sales Manager is in charge of the preparation, the completed figures either in a tentative or completed form are submitted to the Sales Manager for his approval. When finality is reached, the figures are included with the Sales Budget, or as a separate Budget, or as part of a Marketing Expense Budget. Sometimes Advertising Expense is not treated separately, but is prepared in conjunction with Selling Expense, especially where the Sales Manager is in charge of Advertising and the appropriation is small.

2. *The Advertising Expense Budget.*

Even though this is prepared separately, a large amount of co-operation and co-ordination of effort is usually essential. The amount of the advertising appropriation for the coming period is frequently fixed by the Board of Directors or by the Chief Executive, though it is usual for both the Advertising Manager and the Sales Manager to be consulted. All too frequently it is found that an Advertising Budget is not prepared. Very often a statement by the Advertising Manager couched in very general terms is concluded with a submission of a certain sum as a recommendation for the Advertising appropriation for the year or some lesser period, and this has gone forward to the Board of Directors for approval. This method is quite wrong, unless Advertising plays a most insignificant part, a lump sum allowance being then included in Selling Expenses for Budgetary Control purposes. An analysis of the amount set aside for Advertising is necessary, and such analysis should set forth the amounts allowed for each of the various media to be used. This analysis may also be necessary in connection with the fixing of Standards relating to Advertising (see Chapter 27).

3. *Warehousing, Packing and Transportation Costs.*

These are not always treated as part of Marketing Expense, but may be applied as:—

(i) Part of Manufacturing Expense,
(ii) Partly Manufacturing and partly Marketing,
(iii) Separately.

Which of these methods it is best to adopt, depends upon the conditions operating in the business itself. The accounting practice is usually one of the main considerations in determining the best treatment.

Warehouse expense comprises all labour costs in and around the Warehouse, repairs and maintenance of the Warehouse and its equipment and all general expenses (such as rent, caretaking, lighting, heating and insurance) in connection therewith. A study of past costs should quickly yield reliable data on which to estimate the expected charges for the period covered by the budget.

In the case of Packing costs, whilst past results would again be the principal guide in arriving at the estimated future expenses, more notice would in this case have to be taken of the effect which alterations in the expected sales would make, as compared with those of previous periods. For example, some products may require packing, and others may not. Thus, though a Sales increase of only 5% in total may have been allowed for, actually products requiring packing may have been shown at 20% above the previous figures and therefore a larger appropriation for Packing Expenses would be necessary.

Transportation charges can be divided into the following:—

1. Charges representing cartages, freights, postages, etc.:—
    (a) which are not included in the ordinary selling price and are therefore added to the invoice,
    (b) which are included in the ordinary selling price and are therefore not added to the invoice.
2. Charges on incoming goods:—
    (a) which have to be added to the cost of such to arrive at the "in store" cost of the goods,
    (b) which are included in the invoice cost of the goods, and which, if paid by the Company, must be deducted from the invoice cost.
3. Charges representing transportation costs directly or indirectly applicable to an expense account.

It will be seen that some of the expenses in connection with transportation are part of Manufacturing cost, and these should be transferred out of the various accounts so that they can be included in Manufacturing Expense.

When the various Marketing Expenses have been budgeted, it becomes possible to effect transfers to a "Cost to Make and Sell" A/c., similar in every way to those made in relation to Manufacturing Expense. Each account included in Marketing Expense is covered by a Standing Marketing Order, and the various amounts relating to such accounts are posted thereto and controlled in the General Ledger by a Marketing Expense Control A/c. The apportionments to the various products sold would be made on pre-determined bases, such as:—

(a) Estimated Sales value.
(b) Estimated number of units sold.
(c) Estimated Selling Cost.

The amounts thus apportioned would be credited to the various Standing Marketing Orders, and, in total, to the Marketing Expense Control A/c., or, alternatively, if so desired, to an Applied Marketing Expense Control A/c. At the end of the period, the difference between the debits and credits of the Marketing Expense Control A/c. (or alternatively, the debits of the Marketing Expense Control A/c. and the credits of the Applied Marketing Expense Control A/c.) would set forth the amount over or under-absorbed in relation to Marketing Expense. This amount would be covered by the individual debit or credit balances shown in the various Standard Marketing Orders. An analysis of these balances can be particularly valuable from an efficiency standpoint, and this subject is pursued in dealing with standards. (See Chapter 27).

This procedure can be adopted where a division of accounts is made and instead of one only, the following may be used as Controls:—

(a) Selling Expense Control A/c..
(b) Advertising Expense Control A/c,
(c) Warehouse Expense Control A/c.
(d) Packing Expense Control A/c.
(e) Transportation Expense Control A/c.

There seems little doubt that the practice of apportioning Marketing costs to products sold will be more commonly adopted in the future than in the past. In some cases, Marketing expense forms such a large percentage of total cost that such a treatment is almost a necessity. Frequently it is found that elaborate attention is given to the apportionment of Manufacturing costs but Marketing expense is almost disregarded. Whilst the application of Marketing expense to products may in certain cases be a little more arbitrary, it is usually justified and can be of the greatest value from a managerial accounting angle.

ADMINISTRATION EXPENSE.

The following expenses are usually treated as administrative :—

Audit Fees,
Bank Charges,
Cleaning,
Depreciation—Office Machines,
Directors' Fees,
Donations,
Exchange,
Fees and Subscriptions,
Insurance,
Legal Expenses,
Office Supplies,
Postages and Telegrams,
Printing and Stationery,
Rates and Taxes,
Rent,
Salaries,
Travelling Expenses.

Administration Expense can be examined from one of two standpoints. Firstly, it may be treated as representing the whole of the administrative effort, and as such may include the administrative functions of the factory, the warehouse and the office. Where this is so, it is usual to apportion part of the total expense to Factory Expense and part to Selling, the remainder being treated as pure Office Administrative costs. If this procedure is desirable, it is necessary to overcome the difficulty of deciding upon an apportionment basis. Frequently,. an arbitrary percentage is taken, as, for example, 40% to the Factory, 40% to the Selling functions, and 20% to the Office. This is usually unsatisfactory, as it is based upon guesswork. It is a much sounder method to examine each individual account and to make an apportionment in relation to such according to the services rendered by that particular function. Here, again, this may not be as scientific as is desired, but at least it is an improvement upon the arbitrary percentage.

Secondly, the term Administration Expense may be treated soundly and may be interpreted as covering only that expense which is definitely applicable to the directorial and office functions. This method involves an examination of the various functions represented through the accounts, and an apportionment as each arises. If, for example, one of the Directors was associated virtually solely with production, his salary would be charged to Factory Expense. If he drew Director's Fees, these would appear in Administration Expense. By careful analysis of this kind, it is usually possible to arrive at acceptable bases and to reach a stage where Factory Administrative, Selling Administrative, and Office functions are segregated within the accounts to a satisfactory degree.

A more difficult problem arises where it is desired to apportion Administration Expense representing office and directorial functions to the cost of products sold. Any organisation with an acceptable costing system apportions Factory Expense to products manufactured. Some appropriate Selling Expense to products sold, but few seek to transfer Administrative Expense through an appropriation to products. Usually it is considered that the adoption of any basis is so arbitrary as to make the procedure savour of guesswork. There is, however, much to be said for the practice. In the first place, as will be seen later, valuable information is obtained from over or under-absorbed Administrative Expense A/cs. Secondly, the preparation of an Administrative Expense Budget is assured. Thirdly, the practice of apportionment to products of Administrative Expense carries costing through to its logical fulfilment, that is, the cost to make, sell and administer. Frequently, apportionments are made through statistical returns, without any attempt being made to carry such into the accounts.

The procedure necessary to record appropriations to products through accounts is in every way similar to that already described in relation to Marketing Expense. The steps are:—

1. *Prepare an Administrative Expense Budget.*

This can be done by an analysis of past figures, and a projection of expected results in the coming period. Many Administrative expenses are almost of a fixed nature, and therefore the problem of budgeting for these is simplified. The budget is usually prepared either by the Secretary or the Accountant.

2. *Select a Basis for Distribution.*

When the total expense has been arrived at, it is necessary to spread this to the various products sold. The use of an apportionment basis is therefore essential. A thorough examination of all relevant factors should be made before any basis is finally adopted. One of the following may be found suitable:—

(a) Estimated sales.

(b) Estimated number of units sold.

(c) Estimated Selling Cost.

(d) Estimated Manufacturing Cost.

(e) Estimated number of units to be manufactured.

(f) Estimated Gross Profit on sales.

Sometimes it is advisable to adopt two or more bases. Where all Administrative Expense including that really applicable to the Factory or the Sales organisation is covered by the Administrative Expense budget, an apportionment would be made of the amount to be spread to goods manufactured, and the amount to products sold. Even where the Administrative Expense represents the residue after all Administrative costs applicable to manufacturing or selling have been segregated through the accounts, it is very often found advisable to take the office and directorial administrative costs and again apportion these to manufacturing and selling. This may have to be done on an arbitrary basis, based upon a calculation of the service rendered proportionately to the factory and selling. In such a case an apportionment to manufacturing could be made upon such a basis as the number of units to be manufactured, and the selling proportion could be taken up according to the estimated number of units to be sold. Frequently the most favoured basis is that of turnover, and in such a case the formula would be:—

$$\frac{\text{Estimated Administrative Expense for period}}{\text{Estimated Sales for budget period.}}$$

3. *Record the Transactions through the Accounts.*

This would involve the setting up of Standing Administration Orders similar to the Standing Orders covering manufacturing expense. Control would be exercised through an Administrative Expense Control A/c. The various amounts would be debited to the appropriate Orders, and in total to the Control A/c. The amount applied, no matter whether to Manufacturing or Selling, would be credited through the various Orders, and, in total, either to the Control A/c. or to an Applied Administration Expense Control A/c. Thereafter the procedure is similar to that already outlined in connection with Marketing Expense. An examination of the various debit or credit balances appearing in the Standing Administration Orders (and agreeing in total with the difference between the debits and credits in the Control A/c.) would be valuable from an efficiency angle. Any balance appearing in the Control A/c. would, of course, go to the debit or credit of the Profit and Loss A/c. in the final accounting statements.

Once the principal of Control A/cs., as applied to Manufacturing Expense is understood, little difficulty will be experienced in carrying out the accounting records relating to the control of both Marketing and Administration expense.

CHAPTER 13.

FINANCIAL AND COST STATEMENTS.

Closing the Books.

Where a complete cost system is in operation, accounts are usually closed monthly and various statements prepared. In closing and posting cost summaries, the following are usually used:—

1. *Requisition Journal*—to charge materials into production.

2. *Voucher Register*
and
3. *General Journal* —to charge labour and factory expense into production.

4. *Finished Goods Journal*—to transfer the charges for cost of goods completed to Finished Goods Account, and cost of goods sold to Cost of Sales Account.

5. *Sales Journal*—to charge goods sold into Sales Account.

The procedure for closing the books will depend upon the accounting system in use, but usually it will include:—

1. Closing the balance of Cost of Sales Account, the Expense Accounts, and the Income Account to Profit & Loss Account.
2. Closing the balance of Factory Expense Account and Factory Expense Applied Account to Over—and Under—Applied Factory Expense Accounts.
3. Ruling off the Accounts.

These do not differ from ordinary accounting procedure except that the various General Ledger Accounts can be supported by statements of applicable Cost Accounts, as, e.g.:—

General Ledger	*Cost Ledger*
1. Raw Materials A/c.	Statement of balances appearing in the Raw Materials Ledger.
2. Work in Process	Statement of balances appearing on the Cost Sheets remaining open at the end of the period.
3. Finished Stock	Statement of balances appearing in the Finished Stock Ledger.

Preparing Financial Statements and Monthly Reports.

Monthly reports are usually prepared to summarise important totals, thus preventing the burying of important facts in a mass of detail. The statements which are usually prepared are:—

1. *Balance Sheet,* supported where necessary by statement of—
   - (a) Stocks of Materials,
   - (b) Work in Process,
   - (c) Stocks of Finished Goods.

   (Other schedules, such as Sundry Debtors and Sundry Creditors can be added if desired.)
2. *Statement of Profits*—supported where necessary by—
   - (a) Cost of Goods Manufactured,
   - (b) Cost of Goods Sold,
   - (c) Factory Expense and Factory Expense Applied,
   - (d) Selling Expense,
   - (e) General Expense.

It is proposed to consider these briefly.

1. Balance Sheet.

The usual form of the Balance Sheet is well known. Little comment is necessary, except that many items appearing will be supported by separate statements. Under–or Over–Applied Factory Expense is sometimes shown in the Balance Sheet, particularly where it is considered that subsequent months will rectify the position. Over a period, successive balances should offset each other, but balances should not be carried forward from one year to another. They should be written off to Profit & Loss A/c.

2. Statement of Stocks.

Opening Stocks, July 1st, 194—	£3,000
Purchases for Stores—	
Total Debit Postings	17,520
Total	£20,520
Less Materials Issued from Stores—	
Total Credit Postings	11,880
Closing Stocks, July 31st, 194—	£8,640

This is an analysis of charges and credits to Materials Account. It gives information regarding the increase or decrease in the value of materials on hand at the beginning and end of the period, and differences between one period and another should be carefully noted. Supporting statements showing details of Raw Materials Stocks and Work in Process are shown in Figures Nos. 66 & 67 respectively. Finished Stock could be shown in a form similar to Raw Materials (Figure No. 66).

FIGURE No 66.

STATEMENT OF RAW MATERIALS STOCKS,
AS AT 30TH JUNE, 194—.

A/c No.	Description	Location	Maximum	Minimum	July		August		Sept.		Remarks
					Open.	Clos.	Open.	Clos.	Open.	Clos.	

FIGURE No. 67.

STATEMENT OF WORK IN PROCESS,
AS AT 30TH JUNE, 194—.

A/c No.	Description	Location	Materials		Labour		Expense		Total		Remarks
			Open.	Clos.	Open.	Clos.	Open.	Clos.	Open.	Clos.	

(An extra column can be added to show Estimated Cost to Complete, if desired.)

3. Statement of Profits.

Sales		£18,600
Less—		
Cost of Sales	£16,700	
Add Under-Applied Factory Expense	20	16,720
Gross Profit on Sales		£1,880
Selling and General Expenses—		
Selling Expenses	500	
General Expenses	660	1,160
Net Profit on Sales		£720
Non-Operating Expenses and Income—		
Sales Discount...	360	
Less Purchases Discount	300	60
Net Profit for Month		£660

It should be noted that Under-Applied Factory Expense, £20, is added to the Cost of Sales, £16,700, to obtain the actual Cost of Sales, £16,720. With Over-Applied Factory Expense the amount would be subtracted. Where it is desired to show Under-Applied Factory Expense separately, this can be done as under:—

Sales		18,600
Less Cost of Sales		16,700
Gross Profit on Sales		1,900
Selling and General Expenses—		
Selling Expenses	500	
General Expenses	660	1,160
Net Profit on Sales		740
Less Variation from Normal Cost—		
Under-Applied Factory Expense		20
Net Profit on Sales		£720
Financial Expenses—		
Sales Discount...	360	
Less Purchase Discount	300	60
Net Profit for Month		£660

4. Cost of Sales Statement.

Finished Stock, July 1st, 194—	3,600
Add Cost of Goods Manufactured	19,400
Total Available for Sales	23,000
Less Finished Goods Stock, 31/7/4—	6,300
Cost of Sales	£16,700

The statement of Cost of Sales supports the normal cost of sales £16,700, which appears in the Statement of Profits.

This Cost of Sales account is an analysis of finished goods, and shows how these are moving. The above statement shows that the factory produced 16% more during the month than was sold.

5. Statement of Cost of Goods Manufactured.

Direct Materials—		
Materials in Process, July 1st, 194—	3,130	
Materials Used	11,520	
	14,650	
Less Materials in Process, July 31st, 194—	1,160	
		13,490
Direct Labour—		
Labour in Process, July 1st, 194—	770	
Labour Charges to Production	2,910	
	3,680	
Less Labour in Process, July 31st, 194—	370	
		3,310
Factory Expense—		
Factory Expense in Process, July 1st, 194—	600	
Factory Expense Applied	2,360	
	2,960	
Less Factory Expense in Process, 31/7/4—	360	
		2,600
Cost of Goods Manufactured		£19,400

This shows the details of cost of goods manufactured, £19,400. The statement is drawn in three sections:—

(a) Materials,

(b) Labour,

(c) Factory Expense,

each of these being an analysis of the particular Work in Process account. Percentage columns would show the ratio of the cost of each element to the total, and alterations from one month to another should be watched and their significance examined. There are, of course, alternative ways of setting forth these particulars. It should be noted that closing Work in Process is considerably less than the opening.

6. Statement of Factory Expense and Factory Expense Applied.

Particulars	*Amount*
Indirect Materials	£360
Indirect Labour	820
Factory Supplies...	20
Repairs	150
Rent	510
Light and Power	180
Depreciation	150
Insurance	150
Miscellaneous	40
Total Factory Expense	£2,380
Less Applied Factory Expense	2,360
Under-Applied Factory Expense	£20

This provides an analysis of actual factory expense, £2,380, shown in the Factory Expense Control A/c. balance. Percentages could also be shown. At the bottom of the statement, Applied Factory Expense, £2,360 is subtracted from Actual Factory Expense, £2,380, to show Under-Applied Factory Expense of £20. Applied Factory Expense is carried to the state-

ment of Cost of Goods Manufactured, and Under-Applied Factory Expense to the statement of Profits.

Schedules of Selling and General Expense may also be prepared. These would be in the usual form and should require no explanation.

Depending upon the individual circumstances within each organisation, a number of other statements could, if necessary, be prepared, as, for example:—

1. Statement of Spoiled and Defective Work.
2. Statement of Capital Expenditure.
3. Quantity and Quality Production Statements.
4. Statement of Idle Machine Times.
5. Monthly Production Cost Reports.

In addition there would, of course, be Statements setting forth sales statistics and information of value to management.

Comparative Statements.

The foregoing statements show the operations of one month. Comparative statements can be prepared to show this month against last month.

Particulars	*This Month*	*Last Month*	*Season to Date*
Sales	£18,600	£17,130	£
Less Cost of Sales	16,720	14,440	£
Gross Profit on Sales ...	£1,880	£2,690	£

These figures can be extended to cover the full Net Profit position.

"Last month" provides a comparison and where the business is not seasonal it may be an indication of operating efficiency. If the business is a seasonal one, "This Month Last Year" may be substituted for "Last Month." Sometimes statements may be set up so that the various items of the current month may be compared with a standard. In some cases the standard figures may represent a record month in the past or a goal attainable under favourable conditions and under efficient operation.

Particulars	*Standard*	*This Month*	*Variation from Standard*
Sales	£19,000	£18,600	£400*
Less Cost of Sales	17,000	16,720	280
Gross Profit on Sales ...	£2,000	£1,880	£120*

Cost Comparisons.

(a) *Order Costs.*

Material, labour and expenses would be listed and, in addition, the total

FIGURE No. 68.

COMPARATIVE STATEMENT OF ORDER COSTS.

Product " A."

O/No.	Date Finished	No. Pieces	Total Cost	Material	Labour	Factory Expenses	Total Cost per Piece
A99	Jan. 7	290	£4705 5 0	£1345 16 0	£1946 2 6	£1413 6 6	£16 4 6
A100	15	280	4172 0 0	1184 0 0	1615 7 0	1372 13 0	14 18 0
A101	22	290	4379 0 0	1276 4 0	1742 5 0	1360 11 0	15 2 0
A102	31	200	3160 0 0	722 10 0	1248 10 0	1189 0 0	15 16 0

*denotes a Decrease.

cost per unit of each order of a given product completed during the month. By setting out every order on a common basis (unit cost), the statement would show which orders cost too much compared with others, and which element of cost of a given order is out of line. (See Figure No. 68).

(b) *Product Costs.*

This is designed to show whether the cost of a particular product is increasing or decreasing from month to month. The figures generally used would be averages. As each month's costs become available, averages could be compared with previous months to determine the trend. (See Figure No. 69).

FIGURE No. 69.

STATEMENT OF MONTHLY AVERAGE UNIT COSTS.

Product "A."

	Last Year			This Year		
	Jan.	Feb.	March	Jan.	Feb.	March
Material	£14 2 6	£14 5 9	£14 3 4	£15 8 4	£15 10 6	£17 2 6
Labour	8 5 9	8 4 6	8 0 1	8 18 6	9 0 3	8 18 9
Expense	6 14 6	6 14 9	6 14 4	6 16 0	6 15 6	6 19 6
	£29 2 9	£29 5 0	£28 17 9	£31 2 10	£31 6 3	£33 0 9

Statistical Reports.

Various statements of a statistical nature can be prepared, the type of the business governing the form of the statements. Particularly in relation to Standard Costs, these are shown in Chapter 28.

Alternative Forms.

Whilst the foregoing statements should be studied, obviously alternative forms of statements can be prepared. A more detailed statement of Cost of Goods Manufactured is shown in Figure No. 70.

FIGURE No. 70.

STATEMENT OF COST OF GOODS MANUFACTURED.

Materials.			
Opening Stock		10,590	
Spoiled Materials and Scrap-Stock		480	
			£11,070
Add Purchases (including Inwards Charges)	8,460		
Less Discounts Received	240		
			8,220
Total Materials Available			19,290
Less Closing Stock			10,140
			9,150
Less Indirect Materials		450	
Spoilages and Scrap		120	
			570
Total Direct Materials Used			8,580

Labour.			
Cost of Labour			12,120
Expense.			
Factory Variable Expense.			
Indirect Labour	4,460		
Indirect Materials	450		
Spoilages and Scrap	150		
Repairs and Maintenance	640		
Power Charged	360		
Heating	110		
Lighting	60		
Water	40		
Sundry Charges	80		
		6,350	
Factory Fixed Expenses.			
Depreciation—Plant	840		
,, Buildings	110		
Insurance—Work. Comp.	640		
Insurance—Fire	100		
Rates and Taxes	80		
Sundry Charges	110		
		1,880	
Total Factory Overhead		8,230	
Less Factory Expense Over-Applied (Efficiency Variation)		210	
		8,020	
Plus Factory Expense Under-Applied (Spending Variation)		350	
			8,370
Factory Expense Applied to Prod.		£8,370	
Total Manufacturing Cost			29,070
Add Opening Work in Process, July 1st, 194—			
Material	8,460		
Labour	12,590		
Expense	7,420		
			28,470
			57,540
Less Closing Work in Process, July 31st, 194—			
Materials	7,590		
Labour	10,460		
Expense	6,380		
			24,430
Total Cost of Goods Manufactured			£33,110

A further Manufacturing and Trading A/c. is set out hereunder:—

FIGURE No. 71.

MANUFACTURING ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1940.

To Stocks 1/7/1939—			By Stocks 30/6/1940—		
Raw Materials and Work in Process	10,000		Raw Materials and Work in Process	9,000	
Loose Tools	2,000		Loose Tools	1,800	
		12,000			10,800
,, Purchases—			,, Balance, being cost of Finished Goods		33,450
Raw Materials	12,000				
Loose Tools	250				
		12,250			
,, Manufacturing Wages		11,000			
,, Factory Expenses		9,000			
		£44,250			£44,250

TRADING ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1940.

To Stocks Finished Goods 1/7/39	32,500	By Sales	£50,000
„ Cost of Finished Goods, transferred from Manufact. A/c.	33,450		
	65,950		
Less Stock Finished Goods 30/6/40	31,000		
Cost of Goods Sold ...	34,950		
„ Gross Profit transferred to Profit and Loss A/c. ...	15,050		
	£50,000		£50,000

The foregoing forms are indicative only. Statements should be prepared having in mind the use which is to be made of the figures. Statements based on Standard Costs are shown in Chapter 28.

CHAPTER 14.

COST ACCOUNTING PROCEDURE.

JOB ORDER COSTS.

It has been explained in previous chapters that the two main kinds of cost accounting in relation to historical costs are Job Order and Process Costs. The Job Order type is of use in the case of Special Orders, such as carrying out a contract (for example, building a bridge) or manufacturing a specified quantity of articles, such as 20 engines.

Job Order Costs are used not only by those engaged in the special order trade, such as contractors, tailors, shipbuilders, machine shops, and garages, but also those engaged in repetitive operations, such as the manufacture of machinery, furniture, boots and shoes.

An illustration of this type of costing is shown hereunder, in relation to the AZ Company Pty. Ltd. The assets, liabilities and operating figures are as follows:—

SUMMARISED BALANCE SHEET AS AT 30TH JUNE, 194—.

Paid up Capital	£50,000	Land and Buildings	£10,000
Profit and Loss A/c.	16,000	Plant and Machinery	40,000
Reserve for Depreciation ...	10,000	Stock—Finished Goods	12,000
Sundry Creditors	15,000	Stock—in Process...	5,000
Bills Payable	5,000	Stock—Raw Materials	5,000
"A.B." Bank	1,000	Sundry Debtors	20,000
		Bills Receivable	5,000
	£97,000		£97,000

STATEMENT OF RAW MATERIALS ON HAND, AS AT 1ST JULY, 194—.

Material	*Quantity*	*Value*	*Amount*
"u"	1,500	5/-	375 0 0
"w"	15,000	2/6	1,875 0 0
"x"	4,000	6/-	1,200 0 0
"y"	19,000	1/-	950 0 0
"z"	800	15/-	600 0 0
			£5,000 0 0

STATEMENT OF WORK IN PROCESS, AS AT 1ST JULY, 194—.

	Materials	*Labour*	*Expense*	*Total*	*No. of Units*
P/O 236 Prod. "A"	£350	£250	£200	£800	100
P/O 238 ,, "B"	1,650	1,000	800	3,450	500
P/O 239 ,, "C"	300	250	200	750	200
				£5,000	

STATEMENT OF FINISHED GOODS ON HAND, AS AT 1ST JULY, 194—

	Quantity	*Cost*	*Amount*
Product "A"	400	£8	£3,200
„ "B"	800	£10	8,000
„ "C"	160	£5	800
			£12,000

Factory Expense is spread as a percentage on Direct Labour, the rate being 80%.

During the month the transactions are:—

Production Orders issued are as under—

Number	*Product*	*Quantity*
P/O 240	"A"	400
„ 241	"B"	500
„ 242	"A"	200
„ 243	"B"	1,000
„ 244	"C"	500

Purchases made and goods received into store are—

Material	*Quantity*	*Price*	*Amount*
"u"	4,000	6/–	£1,200
"w"	10,000	2/6	1,250
"x"	6,000	5/–	1,500
"y"	20,000	1/–	1,000
"z"	1,000	14/–	700
			£5,650

A summary of Materials Requisitions shows:—

Material	*Quantity*	*Price*	*Amount*
"u"	1,500	5/–	£ 375
"u"	2,000	6/–	600
"w"	12,000	2/6	1,500
"x"	4,000	6/–	1,200
"x"	2,000	5/–	500
"y"	20,000	1/–	1,000
"z"	800	15/–	600
"z"	100	14/–	70
			£5,845

These are chargeable as under—

P/O 236	£50	
„ 238	400	
„ 239	300	
„ 240	1,200	
„ 241	2,000	
„ 242	200	
„ 243	1,000	
„ 244	300	
	5,450	
General Indirect Supplies	395	
		£5,845

The Payroll Analysis shows—

P/O 236	£50
„ 238	500
„ 239	200
„ 240	1,050
„ 241	1,500
„ 242	100
„ 243	500
„ 244	100
	£4,000

The following Jobs are completed during the period:—

P/O 236
„ 238
„ 239
„ 240
„ 241

The following expenses are incurred during the period:—

Repairs—Plant and Machinery	£500
„ —Buildings	50
Light, Heat and Power	350
Water	100
Direct Labour	4,000
Indirect Labour and Supervision	1,000
Factory Expenses	500
Insurance—Factory	300
„ —General	50
Salaries—Sales	800
„ —General	600
Supplies—Sales	200
„ —General	150
Printing and Stationery	50
Interest	50
General Expenses	100
Commissions	200
Audit Fees	20
Bad Debts	20
Collection Expenses	10
	£9,050

Depreciation allowed during the period is:—

Plant and Machinery	£400

Goods sold during the period are—

Product	*Quantity*	*Price*	*Amount*
" A "	500	£12	£6,000
" B "	1,400	10	14,000
" C "	200	8	1,600
			£21,600

Cash payments during the period are:—

Bills Payable	£2,500
Sundry Creditors	£16,250

Cash Receipts during the period are:—

Bills Receivable	£4,000
Sundry Debtors	18,000
Other Income	500

At the end of the period there are only 1,950 units of "u" in stock, and 40 units of "A" are destroyed.

The necessary Journal Entries to give effect to the foregoing are:—

	COST LEDGER	GENERAL LEDGER *Debit*	GENERAL LEDGER *Credit*
Paid up Capital			£50,000
Profit and Loss A/c.			16,000
Reserve for Depreciation			10,000
Sundry Creditors			15,000
Bills Payable			5,000
A.B. Bank			1,000
Land and Buildings		£10,000	
Plant and Machinery		40,000	
Sundry Debtors		20,000	
Bills Receivable		5,000	
Finished Goods—		12,000	
"A"—400 @ £8	£3,200		
"B"—800 @ £10	8,000		
"C"—160 @ £5	800		
Work in Process—		5,000	
"A"—100—Materials	350		
Labour	250		
Expense—(£800)	200		
"B"—500—Materials	1,650		
Labour	1,000		
Expense—(£3,450)	800		
"C"—200—Materials	300		
Labour	250		
Expense—(£750)	200		
Raw Materials—		5,000	
"u"— 1,500 @ 5/-	375		
"w"—15,000 @ 2/6	1,875		
"x"— 4,000 @ 6/-	1,200		
"y"—19,000 @ 1/-	950		
"z"— 800 @ 15/-	600		
(Being Opening Balances journalised for Posting to Ledgers.)			
Raw Materials—		5,650	
"u"— 4,000 @ 6/-	1,200		
"w"—10,000 @ 2/6	1,250		
"x"— 6,000 @ 5/-	1,500		
"y"—20,000 @ 1/-	1,000		
"z"— 1,000 @ 14/-	700		
Repairs—Plant and Machinery		500	
,, —Buildings		50	
Light, Heat and Power		350	
Water		100	
Direct Labour		4,000	
Indirect Labour and Supervision		1,000	
Factory Expenses		500	
Insurance—Factory		300	
,, —General		50	
Supplies—Sales		200	
,, —General		150	
Salaries—Sales		800	
,, —General		600	
Printing and Stationery		50	
Interest		50	

	COST LEDGER	GENERAL LEDGER	
		Debit	*Credit*
General Expenses		£100	
Commissions...		200	
Audit Fees		20	
Bad Debts		20	
Collection Expenses		10	
To Sundry Creditors			£14.700
(Being Sundry Expenses incurred during the period.)			
Work in Process—		£5,450	
P/O 236	£50		
„ 238	400		
„ 239	300		
„ 240	1,200		
„ 241	2,000		
„ 242	200		
„ 243	1,000		
„ 244	300		
General Indirect Supplies		395	
To Raw Materials—			5,845
" u "	975		
" w "	1,500		
" x "	1,700		
" y "	1,000		
" z "	670		
(Being issues of Raw Materials as per Requisitions Summary.)			
Work in Process—		4,000	
P/O 236	50		
„ 238	500		
„ 239	200		
„ 240	1,050		
„ 241	1,500		
„ 242	100		
„ 243	500		
„ 244	100		
To Direct Labour			4,000
(Being charges as per Payroll Summary.)			
Work in Process—		3,200	
P/O 236—80% of £ 50	40		
„ 238— „ „ 500	400		
„ 239— „ „ 200	160		
„ 240— „ „ 1,050	840		
„ 241— „ „ 1,500	1,200		
„ 242— „ „ 100	80		
„ 243— „ „ 500	400		
„ 244— „ „ 100	80		
To Applied Factory Expense			3,200
(Being charges to jobs for Factory Expense as per Budgeted Rates.)			
Finished Goods—		14,890	
Product " A "	£4,030		
„ " B "	9,450		
„ " C "	1,410		
To Work in Process—			14,890
P/O 236—100 units @ £9/8/-	£940		
„ 238—500 „ „ £9/10/-	4,750		
„ 239—200 „ „ £7/1/-	1.410		
„ 240—400 „ „ £7/14/6	3,090		
„ 241—500 „ „ £9/8/-	4,700		
(Being transfer of Finished Goods from Work in Process.)			
Depreciation...		400	
To Depreciation Reserve			400
(Being allowance for Depreciation for the period.)			

	COST LEDGER	GENERAL LEDGER	
		Debit	*Credit*
Sundry Debtors		£21,600	
To Sales—			£21,600
"A"—£6,000			
"B"—14,000			
"C"—1,600			
(Being goods sold during the period.)			
Cost of Sales—		18,912	
"A"—400 @ £8			
100 @ £9/8/-	4,140		
"B"—800 @ £10			
500 @ £9/10/-			
100 @ £9/8/-	13,690		
"C"—160 @ £5			
40 @ £7/1/-	1,082		
To Finished Goods			18,912
(Being cost of goods sold during period.)			
Stock Adjustment—Raw Materials		15	
To Raw Materials			15
—50 units of "u"	15		
(Being 50 units of "u" stolen.)			
Stock Adjustment—Finished Goods		309	
To Finished Goods—			309
40 units "A" @ £7/14/6	309		
(Being 40 units of "A" destroyed.)			

The following adjustments and transfers would be made at the end of the period:—

July 31 Trading A/c.		£410	
To Manufacturing Expense			
Adjustment A/c.			410
(Being expenses short applied transferred to Trading A/c)			
July 31 Manufacturing Expense			
Adjustment A/c.		3,595	
To Repairs—Plant and Mach.			500
„ „ —Buildings			50
„ Light, Heat and Power			350
„ Water			100
„ Indirect Labour			1,000
„ General Fact. Exs.			895
„ Insurance—Factory			300
„ Depreciation			400
(Being Transfer of Factory Expenses)			
July 31 Manufacturing Expense			
Adjustment A/c.		15	
To Stock Adjust.—Raw Mat.			15
50 units "u" spoiled...	15		
(Being raw materials stock adjustment transferred)			
July 31 Applied Factory Expense A/c.		3,200	
To Manufact. Ex. Adjust. A/c. ...			3,200
(Being transfer of amount of manufacturing expenses applied to jobs)			
July 31 Sales		21,600	
To Trading A/c. ...			21,600
(Being sales for period transferred)			

	COST LEDGER	GENERAL LEDGER	
		Debit	*Credit*
July 31 Trading A/c.		£18,912	
To Cost of Sales A/c.			£18,912
(Being cost of sales for period transferred)			
July 31 Trading A/c.		309	
To Stock Adjustment—Finished Goods			309
(Being Finished Goods adjust. transferred)			
July 31 Other Income A/c.		500	
To P. & L. A/c.			500
(Being transfer of Balance)			
July 31 Trading A/c.		1,969	
To P. & L. A/c.			1,969
(Being transfer of Gross Profit)			
July 31 Profit and Loss A/c.		1,969	
To Insurance—General			50
„ Salaries—Sales			800
„ „ —General			600
„ Supplies—Sales			200
„ „ —General			150
„ Printing and Stationery			50
„ Interest			50
„ General Expenses			100
„ Commissions			200
„ Audit Fees			20
„ Bad Debts			20
„ Collection Expenses			10
(Being transfer of balances to P. & L. A/c.)			

General Ledger Entries.

The foregoing Journal Entries would be posted to the various Ledger Accounts as under:—

PAID UP CAPITAL A/c.

		July 1 By Balance b/d ...	£50,000

PROFIT & LOSS A/c.

July 31 To Balance c/d ...	£16,219	July 1 By Balance b/d ...	£16,000
		31 „ Net Profit ...	219
	£16,219		£16,219
		July 31 By Balance b/d ...	£16,219

RESERVE FOR DEPRECIATION.

July 31 To Balance c/d ...	£10,400	July 1 By Balance b/d ...	£10,000
		„ 31 „ Charges	400
	£10,400		£10,400
		July 31 By Balance b/d ...	£10,400

SUNDRY CREDITORS A/c.

July 31 To Cash	£16,250	July 1 By Balance b/d ...	£15,000
„ 31 „ Balance c/d ...	£13,450	„ 31 „ Sundry Accounts	14,700
	£29,700		£29,700
		July 31 By Balance b/d ...	£13,450

BILLS PAYABLE A/c.

July 31	To Cash	£2,500	July 1	By Balance b/d ...	£5,000
„ 31	„ Balance c/d ...	£2,500			
		£5,000			£5,000
			July 31	By Balance b/d ...	£2,500

LAND & BUILDINGS A/c.

July 1	To Balance b/d ...	£10,000			

PLANT & MACHINERY A/c.

July 1	To Balance b/d ...	£40,000			

SUNDRY DEBTORS' A/c.

July 1	To Balance b/d ...	£20,000	July 31	By Cash	£18,000
„ 31	„ Sales	21,600	„ „	„ Balance c/d ...	23,600
		£41,600			£41,600
Aug. 1	To Balance b/d ...	£23,600			

BILLS RECEIVABLE A/c.

July 1	To Balance b/d ...	£5,000	July 31	By Cash	£4,000
			„ „	„ Balance c/d ...	1,000
		£5,000			£5,000
Aug. 1	To Balance b/d ...	£1,000			

FINISHED GOODS A/c.

July 1	To Balance b/d ...	£12,000	July 31	By Cost of Sales ...	£18,912
„ 31	„ Work in Process	14,890	„ „	„ Spoilage	309
			„ „	„ Balance c/d ...	7,669
		£26,890			£26,890
Aug. 1	To Balance b/d ...	£7,669			

SALES A/c.

July 31	To Trading A/c ...	£21,600	July 31	By Sundry Debtors	£21,600

COST OF SALES A/c.

July 31	To Finished Goods	£18,912	July 31	By Trading A/c ...	£18,912

OTHER INCOME A/c.

July 31	To Profit & Loss A/c	£500	July 31	By Cash	£500

WORK IN PROCESS A/c.

July 1	To Balance b/d ...	£5,000	July 31	By Finished Goods ...	£14,890
„ 31	„ Materials Issues	5,450	„ „	„ Balance c/d ...	2,760
„ 31	„ Direct Labour ...	4,000			
„ 31	„ Applied Fact. Ex.	3,200			
		£17,650			£17,650
Aug. 1	To Balance b/d ...	£2,760			

RAW MATERIALS A/c.

July 1	To Balance b/d ...	£5,000	July 31	By Work in Process	£5,845
„ 31	„ Purchases ...	5,650	„ 31	„ Stock Adjustment	15
			„ 31	„ Balance c/d ...	4,790
		£10,650			£10,650
Aug. 1	To Balance b/d ...	£4,790			

"A.B." BANK A/c.

July 31	To Cash Receipts ...	22,500	July 1	By Balance	1,000
			„ 31	„ Cheques	18,750
			„ 31	„ Balance c/d ...	2,750
		£22,500			£22,500
Aug. 1	To Balance b/d ...	£2,750			

REPAIRS—PLANT & MACHINERY A/c.

July 31	To Charges	£500	July 31	By Manuf. Expens. Adjust. A/c ...	£500

REPAIRS A/c.—BUILDINGS.

July 31	To Charges	£50	July 31	By Man. Ex. Adj. A/c	£50

LIGHT, HEAT & POWER A/c.

July 31	To Charges	£350	July 31	By Man. Ex. Adj. A/c	£350

WATER A/c.

July 31	To Charges	£100	July 31	By Man. Ex. Adj. A/c	£100

DIRECT LABOUR A/c.

July 31	To Charges, as per Payroll Sumy.	£4,000	July 31	By Work in Process...	£4,000

INDIRECT LABOUR A/c.

July 31	To Charges, as per Payroll Sumy.	£1,000	July 31	By Manufact. Exps. Adjust. A/c ...	£1,000

GENERAL FACTORY EXPENSES A/c.

July 31	To Charges	£500	July 31	By Man. Exs. Adjust. A/c	£895
„ 31	„ Material Issues ...	395			
		£895			£895

INSURANCE A/c.—FACTORY.

July 31	To Charges	£300	July 31	By Man. Ex. Adj. A/c	£300

INSURANCE A/c.—GENERAL.

July 31	T Charges	£50	July 31	By Profit & Loss A/c	£50

SALARIES A/c.—SALES.

July 31	To Charges	£800	July 31	By Profit & Loss A/c	£800

SALARIES A/c.—GENERAL.

July 31	To Charges	£600	July 31	By Profit & Loss A/c	£600

SUPPLIES A/c.—SALES.

July 31	To Charges	£200	July 31	By Profit & Loss A/c	£200

SUPPLIES A/c.—GENERAL.

July 31	To Charges	£150	July 31	By Profit & Loss A/c	£150

PRINTING & STATIONERY A/c.

July	31	To Charges	£50	July 31	By Profit & Loss A/c	£50

INTEREST A/c.

July	31	To Charges	£50	July 31	By Profit & Loss A/c	£50

GENERAL EXPENSES A/c.

July	31	To Charges	£100	July 31	By Profit & Loss A/c	£100

COMMISSIONS A/c.

July	31	To Charges	£200	July 31	By Profit & Loss A/c	£200

AUDIT FEES A/c.

July	31	To Charges	£20	July 31	By Profit & Loss A/c	£20

BAD DEBTS A/c.

July	31	To Charges	£20	July 31	By Profit & Loss A/c	£20

COLLECTION EXPENSES A/c.

July	31	To Charges	£10	July 31	By Profit & Loss A/c	£10

APPLIED FACTORY EXPENSES A/c.

July	31	To Man. Ex. Adjust. A/c	£3,200	July 31	By Charges Applied ...	£3,200

DEPRECIATION A/c.

July	31	To Charges	£400	July 31	By Man. Ex. Adjust. A/c	£400

STOCK ADJUSTMENT A/c.—RAW MATERIALS.

July	31	To Adjustment ...	£15	July 31	By Man. Ex. Adjust. A/c	£15

STOCK ADJUSTMENT A/c.—FINISHED STOCK.

July	31	to Adjustment ...	£309	July 31	By Trading A/c ...	£309

Cost Ledger Entries.

In addition to the General Ledger entries, recordings in the Cost Ledger would also be necessary. These are shown hereunder.

(a) *Raw Materials.*

The entries to record entries relating to Raw Materials would be—

RAW MATERIALS LEDGER.

" u " Material.

July	1	To Stock on Hand— 1,500 @ 5/- ...	£375	July	31	By Issues— 1,500 @ 5/- ...	£375
„	31	„ Purchases— 4,000 @ 6/- ...	1,200	„	31	„ Issues— 2,000 @ 6/- ...	600
				„	31	„ Spoilage— 50 @ 6/- ...	15
				„	31	„ Balance c/d— 1,950 @ 6/- ...	585
			£1,575				£1,575
Aug.	1	To Stock on Hand— 1,950 @ 6/- ...	£585				

" w " Material.

July 1	To Stock on Hand—		July 31	By Issues—	
	15,000 @ 2/6	1,875		12,000 @ 2/6 ...	1,500
„ 31	„ Purchases—		„ 31	„ Balance c/d—	
	10,000 @ 2/6	1,250		13,000 @ 2/6 ...	1,625
		£3,125			£3,125
Aug. 1	To Stock on Hand—				
	13,000 @ 2/6	£1,625			

" x " Material.

July 1	To Stock on Hand—		July 31	By Issues—	
	4,000 @ 6/- ...	£1,200		4,000 @ 6/- ...	1,200
„ 31	„ Purchases—			2,000 @ 5/- ...	500
	6,000 @ 5/- ...	1,500	„ 31	„ Balance c/d—	
				4,000 @ 5/-	1,000
		£2,700			£2,700
Aug. 1	To Stock on Hand—				
	4,000 @ 5/- ...	£1,000			

" y " Material.

July 1	To Stock on Hand—		July 31	By Issues—	
	19,000 @ 1/-	£950		20,000 @ 1/- ...	1,000
„ 31	„ Purchases—		„ 31	„ Balance c/d—	
	20,000 @ 1/-	1,000		19,000 @ 1/- ...	950
		£1,950			£1,950
Aug. 1	To Stock on Hand—				
	19,000 @ 1/-	£950			

" z " Material.

July 1	To Stock on Hand—		July 31	By Issues—	
	800 @ 15/- ...	£600		800 @ 15/- ...	600
„ 31	„ Purchases—			100 @ 14/- ...	70
	1,000 @ 14/-	700	„ 31	„ Balance c/d—	
				900 @ 14/- ...	630
		£1,300			£1,300
Aug. 1	To Stock on Hand—				
	900 @ 14/- ...	£630			

RAW MATERIALS LEDGER—SUMMARY OF BALANCES.

" u " Material	£585
" w " „	1,625
" x " „	1,000
" y " „	950
" z " „	630
Balance as per General Ledger A/c ...	£4,790

(b) *Cost Ledger Sheets.*

The various Cost Sheets would be prepared and shown as follows:—

COST SHEETS.

P/O 236.—" A."

	Material	*Labour*	*Expense*
To Work in Process	350	250	200
„ Material Requisition	50		
„ Payroll Summary		50	
„ Applied Factory Expense			40
	£400	£300	£240

Total Completed Cost	£940
Number of Units	100
Cost per Unit	£9/8/-

P/O 238.—" B."

	Material	*Labour*	*Expense*
To Work in Process	1,650	1,000	800
„ Material Requisition	400		
„ Payroll Summary		500	
„ Applied Factory Expense			400
	£2,050	£1,500	£1,200

Total Completed Cost	£4,750
Number of Units	500
Cost per Unit	£9/10/-

P/O 239.—" C."

	Material	*Labour*	*Expense*
To Work in Process	300	250	200
„ Material Requisition	300		
„ Payroll Summary		200	
„ Applied Factory Expense			160
	£600	£450	£360

Total Completed Cost	£1,410
Number of Units	200
Cost per Unit	£7/1/-

P/O 240.—" A."

	Material	*Labour*	*Expense*
To Material Requisition	1,200		
„ Payroll Summary		1,050	
„ Applied Factory Expense			840
	£1,200	£1,050	£840

Total Completed Cost	£3,090
Number of Units	400
Cost per Unit	£7/14/6

P/O 241.—" B."

	Material	*Labour*	*Expense*
To Material Requisition	2,000		
„ Payroll Summary		1,500	
„ Applied Factory Expense			1,200
	£2,000	£1,500	£1,200

Total Completed Cost	£4,700
Number of Units	500
Cost per Unit	£9/8/-

P/O 242.—" A."

	Material	Labour	Expense
To Material Requisition	200		
„ Payroll Summary		100	
„ Applied Factory Expense			80
	£200	£100	£80

Total Work in Process £380

P/O 243.—" B."

	Material	Labour	Expense
To Material Requisition	1,000		
„ Payroll Summary		500	
„ Applied Factory Expense			400
	£1,000	£500	£400

Total Work in Process £1,900

P/O 244.—" C."

	Material	Labour	Expense
To Material Requisition	300		
„ Payroll Summary		100	
„ Applied Factory Expense			80
	£300	£100	£80

Total Work in Process £480

COST SHEET BALANCES.

P/O Number	*Product*	*Amount*
P/O 242	" A "	£380
„ 243	" B "	1,900
„ 244	" C "	480
Balance as per General Ledger A/c.		£2,760

The entries in the Finished Goods Ledger would be:—

FINISHED GOODS LEDGER.

Product " A."

July 1	To Stock on Hand— 400 @ £8 ...	£3,200	July 31	By Cost of Sales— 400 @ £8 ...	£3,200
„ 31	„ P/O 236— 100 @ £9/8/-	940		100 @ £9/8/-...	940
„ 31	„ P/O 240— 400 @ £7/14/6	3,090	„ 31	„ Spoilage— 40 @ £7/14/6...	309
			„ 31	„ Stock on Hand— 360 @ £7/14/6	2,781
		£7,230			£7,230
Aug. 1.	To Stock on Hand	£2,781			

Product " B."

July 1	To Stock on Hand— 800 @ £10 ...	8,000	July 31	By Cost of Sales— 800 @ £10 ...	8,000
„ 31	„ P/O 238— 500 @ £9/10/-	4,750		500 @ £9/10/-	4,750
				100 @ £9/8/-...	940
„ 31	„ P/O 241— 500 @ £9/8/-	4,700	„ 31	„ Stock on Hand-- 400 @ £9/8/-...	3,760
		£17,450			£17,450
Aug. 1	To Stock on Hand—	£3,760			

Product " C."

July 1	To Stock on Hand—		July 31	By Cost of Sales—	
	160 @ £5 ...	800		160 @ £5 ...	800
" 31	" P/O 239—			40 @ £7/1/- ...	282
	200 @ £7/1/-	1,410	" 31	" Stock on Hand—	
				160 @ £7/1/-...	1,128
		£2,210			£2,210
Aug. 1	To Stock on Hand ...	£1,128			

Summary of Balances as at July 31st, 194–

Product " A "	£2,781
" " B "	3,760
" " C "	1,128
	£7,669

Balance as per Finished Goods A/c in General Ledger—£7,669.

Final Statements.

These would be prepared as under:—

PRELIMINARY TRIAL BALANCE AS AT 31st JULY 19......

	Debit	*Credit*
Paid Up Capital		£50,000
Profit and Loss A/c		16,000
Reserve for Depreciation		10,400
Sundry Creditors		13,450
Bills Payable		2,500
Land and Buildings	10,000	
Plant and Machinery	40,000	
Sundry Debtors	23,600	
Bills Receivable	1,000	
Finished Goods	7,978	
Sales		21,600
Cost of Sales	18,912	
Other Income		500
Work in Process	2,760	
Raw Material	4,805	
" A.B." Bank	2,750	
Repairs—Plant and Machinery	500	
" Buildings	50	
Light, Heat and Power	350	
Water	100	
Indirect Labour	1,000	
General Factory Expenses	895	
Insurance—Factory	300	
" General	50	
Salaries—Sales	800	
" General	600	
Supplies A/c—Sales	200	
Supplies A/c—General	150	
Printing and Stationery	50	
Interest	50	
General Expenses	100	
Commissions	200	
Audit Fees	20	
Bad Debts	20	
Collection Expenses	10	
Applied Factory Expenses		3,200
Depreciation	400	
	£117,650	£117,650

MANUFACTURING EXPENSE ADJUSTMENT A/c.

for Month ended 31st July, 194–.

July 31	To Repairs—Plant & Mach.	£500	July 31	By Manufact. Exs. Applied ...	3,200
	„ „ —Buildings	50	„ 31	„ Transfer to Trading A/c ... ... (Being expenses short applied)	410
	„ Light, Heat and Power	350			
	„ Water	100			
	„ Indirect Labour...	1,000			
	„ General Factory Exp.	895			
	„ Insurance—Fact.	300			
	„ Depreciation ...	400			
	„ Stock Adjustment —Raw Material	15			
		£3,610			£3,610

TRADING A/c.

for month ended July 31st, 194–.

July 31	To Cost of Sales— " A "—£4,140 " B "—£13,690 " C "—£1,082	18,912	July 31	By Sales— " A "—£6,000 " B "—£14,000 " C "—£1,600	21,600
	„ Manufact. Exs. short applied ...	410			
	„ Stock Adjustment A/c	309			
	„ Gross Profit transferred ...	1,969			
		£21,600			£21,600

PROFIT AND LOSS A/c.

for month ended July 31st, 194–.

July 31	To Insurance— General ...	50	July 31	By Gross Profit from Trading A/c ...	1,969
	„ Salaries—Sales ...	800	„ 31	By Net Operating Loss c/d	281
	„ „ General	600			
	„ Supplies—Sales ...	200			
	„ „ General	150			
	„ Printing and Stationery ...	50			
	„ Interest	50			
	„ General Expenses	100			
	„ Commission ...	200			
	„ Audit Fees ...	20			
	„ Bad Debts ...	20			
	„ Collection Exp.	10			
		£2,250			£2,250
	„ To Net Operating Loss b/d ...	281	July 31	By Other Income ...	500
	„ Net Profit ...	219			
		£500			£500

CLOSING BALANCES

as at 31st July, 194–.

Paid up Capital ...		£50,000
Profit and Loss A/c ...		16,219
Reserve for Depreciation ...		10,400
Sundry Creditors ...		13,450
Bills Payable ...		2,500
Land and Buildings ...	10,000	
Plant and Machinery ...	40,000	
Sundry Debtors ...	23,600	
Bills Receivable ...	1,000	
Finished Stock ...	7,669	
Work in Process ...	2,760	
Raw Materials ...	4,790	
" A.B.A." Bank A/c ...	2,750	
	£92,569	£92,569

STATEMENT OF UNIT COSTS.

PRODUCT " A."

	P/O 236		P/O 240	
	Total	*Unit Cost*	*Total*	*Unit Cost*
Materials ...	£400	£4 0 0	£1,200	£3 0 0
Labour ...	300	3 0 0	1,050	2 12 6
Expenses ...	240	2 8 0	840	2 2 0
Total ...	£940	£9 8 0	£3,090	£7 14 6

PRODUCT " B."

	P/O 238		P/O 241	
	Total	*Unit Cost*	*Total*	*Unit Cost*
Materials ...	£2,050	£4 2 0	£2,000	£4 0 0
Labour ...	1,500	3 0 0	1,500	3 0 0
Expense ...	1,200	2 8 0	1,200	2 8 0
Total ...	£4,750	£9 10 0	£4,700	£9 8 0

PRODUCT " C."

	P/O 239	
	Total	*Unit Cost*
Materials ...	£600	£3 0 0
Labour ...	450	2 5 0
Expense ...	360	1 16 0
	£1,410	£7 1 0

CHAPTER 15.

COST ACCOUNTING PROCEDURE.

PROCESS COSTS.

Apart from Job Order Costs, Process costing is one of the most common types of costing methods. As was explained in previous chapters, it is of use when the product is manufactured as the result of a sequence of continuous operations.

An illustration of this type of costing is shown hereunder, and it will be seen that the final cost of the product is developed through the various departmental costs. This type of Process Costing is used in such businesses as Chemical Works, Fellmongering, Paint & Varnishes, Textiles and the extractive industries such as Timber and Mining.

The following illustration is that of a Cement Company and the operations have been kept as simple as possible consistent with explaining the principles.

The various figures relating to the assets, liabilities and operating results of the Sol. Cement Company Pty. Ltd. are as under:—

		£	£
" A.B.C." Bank		4,500	
" X.Y.Z." Bank		28,000	
Sundry Debtors		30,500	
Bills Receivable		3,500	
Work in Process—Quarrying	£2,000		
" " " Other	3,000		
		5,000	
Stocks—			
Finished Cement—90,000 barrels		18,000	
Supplies		21,500	
Explosives		2,000	
Coal		8,500	
New Cloth Bags		16,000	
Second Hand Cloth Bags		1,500	
Paper Bags		3,400	
Sack Suspense A/c		6,000	
Mill Land		2,500	
Mill Buildings		44,200	
Mill Machinery		110,000	
Quarry No. 1—Land		8,000	
" " 2— "		11,400	
Huts, Sheds, etc.		2,200	
Quarry Machinery		6,800	
Govt. Bonds		15,000	
Petty Cash		50	
Paid Up Capital			200,000
Profit and Loss A/c			26,850
Debentures			40,000
Sundry Creditors			18,000
Bills Payable			2,000
Reserves—General			15,000
Depreciation—Mill Buildings			9,000
Mill Machinery			27,000
Mill Land			500
Quarry Machinery			1,400
Huts, Sheds, etc.			800
Depletion—Quarry No. 1			3,000
Quarry No. 2			2,000
Contingencies			3,000
		£348,550	£348,550

Work in Process consists of—

Quarrying—10,000 tons Cement Rock		£1,500
7,500 tons Limestone		500
Other—Raw Grinding		Nil
Clinker Burning		Nil
Clinker Grinding—15,000 barrels		£3,000
Material—100% Complete	£2,325	
Labour— 80% Complete—	175	
Factory Expense—80% Complete—	500	

At the end of the period the Purchases Journal shows:—

Supplies	£4,500
Coal	1,200
New Cloth Bags—Stock	6,000
Suspense	1,000
Paper Bags	500
Wages	7,830
Printing and Stationery	100
Rent	50
Sundry Office Expenses	150
Sundry Distribution Expenses	340

Analysis of the Payroll shows:—

Work in Process—Quarrying—		
Superintendence	50	—Cement £40 —Limestone £10
General Operating Labour	1,800	—£1,300 Cement, 500 Limestone.
Work in Process—Other—		
Raw Grinding	2,150	
Clinker Burning	1,150	
Clinker Grinding	750	
(General Operating Labour)		
Factory Service—		
Superintendence	50	
Office and Stores	200	
Laboratory	80	
Coal Preparing—Operating Labour	120	
Power, Light and Water—Operating Labour	450	
Machine Shop—Foremen	50	
Operating Labour	500	
Floating Gang—Foreman	40	
Labour	110	
Packing and Loading	150	
Bag Handling	180	

A summary of the Materials and Supplies for the period shows:—

	Operating	*Repair*
Supplies—Work in Process Quarrying—		
Cement Rock	100	500
Limestone	40	20
Supplies—Work in Process Other—		
Raw Grinding	150	320
Clinker Burning	140	490
Clinker Grinding	120	320
Coal Preparing	200	180
Power, Light and Water	590	270
Machine Shop	30	10
Floating Gang	20	
Packing and Loading	20	20
Bag Handling	10	10
Factory Service		40
	£1,420	£2,180

Explosives—Work in Process—Quarrying—	
Cement Rock	£400
Limestone	50
Coal—Work in Process—Quarrying—	
Cement Rock	400
Limestone	200
Work in Process—Other—	
Raw Grinding	100
Coal Preparing	4,000
Power, Light and Water	4,000
Machine Shop	100

Cost of the Floating Gang is distributed as under:—

Packing and Loading	40
Sack Handling	40
Factory Service	30
Work in Process—Quarrying—	
Cement Rock	30
Limestone	30

The total cost of the account, Power, Light & Water, is to be apportioned as follows:—

Work in Process—Quarrying—	
Cement Rock	30
Work in Process—Other—	
Raw Grinding	1,400
Clinker Burning	1,200
Clinker Grinding	1,350
Coal Preparing	1,080
Machine Shop	50
Packing and Loading	100
Bag Handling	50

The cost of the Machine Shop is to be apportioned as follows:—

Work in Process—Quarrying—	
Cement Rock	120
Limestone	20
Work in Process—Other—	
Raw Grinding	200
Clinker Burning	140
Clinker Grinding	90
Coal Preparing	60
Power, Light and Water	50
Packing and Loading	30
Bag Handling	10
Factory Service	20

Provision must also be made for the following:—

Work in Process—Quarrying—		
Cement Rock	£200	
Limestone	50	
Factory Service	2,000	
Dwelling Expense	50	
Reserve for Depreciation—		
Quarry No. 1—Machinery		200
„ „ 2—Machinery		70
Mill Buildings		150
Mill Machinery		1,830
Huts, Sheds, etc.		50

Work in Process—Quarrying—		
Cement Rock	£50	
Limestone	20	
Reserve for Depletion—		
Quarry No. 1		£50
Quarry No. 2		20
Packing and Loading	100	
Accrued Royalties		100

A summary of Sales made is shown hereunder:—

Sales of Cement (90,000 barrels @ 5/-, 35,868 barrels @ 6/11.64d.)	£35,000
Bags—Cloth—new charged to customers at 1/—100,000	5,000
Bags—Cloth—Secondhand—charged to customers at 6d.—10,000	250
Bags—Paper—new charged to customers at 3d.—100,000	1,250
	£41,500

Credits to customers for 80,000 at 1/-	£4,000

Summary of Cash Receipts shows:—

Sundry Debtors	£34,000
Interest	500
Rent of Huts, Sheds, etc.	250

Deposited in X.Y.Z. Bank

Summary of Cash Disbursements shows:—

Sundry Creditors			19,800
Payroll			7,830
Sales—Office Salaries	300	Sundry Distribution Expenses	
„ Expenses	80		
Salesmen's Salaries	450		
„ Expenses	100		930
General Salaries	500		
„ Expenses	50	Sundry Office Exs.	550
Postages and Telegrams			50
Miscellaneous Expense			100

Drawn from X.Y.Z. Bank.

The cement rock process shows 10,000 tons on hand at the beginning fully completed, 20,000 tons transferred to raw grinding during the period, and 15,000 fully completed tons at the end.

The limestone process shows 8,000 tons on hand at the beginning fully completed, 16,000 tons transferred to raw grinding and 8,000 tons fully completed on hand at the end.

£1,000 worth of Gypsum has been used in connection with clinker grinding.

Factory service cost is spread over the raw grinding, clinker burning and clinker grinding cost sheets in proportion to the operating labour in each process.

Raw Grinding process shows an output of 80,000 barrels with no stocks at the beginning or the end of the period.

The Clinker burning process shows 75,000 barrels completed and transferred to the next process. The closing stock shows 5,000 barrels in which material is complete, labour and factory service 80% complete.

The clinker grinding process has 15,000 barrels partly completed as opening stock, and an output of 75,000 barrels.

The various Journal Entries to record the foregoing would be as follows:—

	Debit	*Credit*
	£	£
"A.B.C." Bank	4,500	
"X.Y.Z." Bank	28,000	
Sundry Debtors	30,500	
Bills Receivable	3,500	
Work in Process—		
Quarrying—10,000 tons Quarrying	2,000	
7,500 tons Other	3,000	
Clinker Grinding—15,000 barrels—		
Material—100%—£2,325		
Labour— 80%—£175		
Fact. Exs.— 80%—£500		
Stocks—		
Finished Cement—90,000 barrels	18,000	
Supplies	21,500	
Explosives	2,000	
Steam Coal	8,500	
New Cloth Bags	16,000	
Second Hand Cloth Bags	1,500	
Paper Bags	3,400	
Sack Suspense A/c	6,000	
Mill Land	2,500	
Mill Buildings	44,200	
Mill Machinery	110,000	
Quarry No. 1—Land	8,000	
„ „ 2—Land	11,400	
Quarry Machinery	6,800	
Huts, Sheds, etc.	2,200	
Government Bonds	15,000	
Petty Cash	50	
To Paid Up Capital		200,000
„ Profit and Loss A/c		26,850
„ Debentures		40,000
„ Sundry Creditors		18,000
„ Reserves—General		15,000
„ Bills Payable		2,000
„ Depreciation—Mill Buildings		9,000
„ „ —Mill Machinery		27,000
„ „ —Mill Land		500
„ „ —Quarry Machinery		1,400
„ „ —Huts, Sheds, etc.		800
„ Depletion—Quarry No. 1		3,000
„ „ — „ „ 2		2,000
„ Contingencies		3,000
(To record Opening Balances)		
Supplies	4,500	
Coal	1,200	
New Cloth Bags—Stock	6,000	
„ „ „ —Suspense	1,000	
Paper Bags	500	
Wages	7,830	
Printing and Stationery	100	
Rent	50	
Sundry Office Expenses	150	
Sundry Dist. „	340	
To Sundry Creditors		13,840
„ Accrued Payroll		7,830
(Being dissection of accounts accrued during the period)		

	Debit £	Credit £
Work in Process—Quarrying—		
Superintendence—Cement— £40		
Limestone— £10	50	
General Operating Labour—		
Cement— £1,300		
Limestone— 500	1,800	
Work in Process—Other—		
Raw Grinding	2,150	
Clinker Burning	1,150	
Clinker Grinding	750	
Factory Service—		
Superintendence	50	
Office and Stores	200	
Laboratory	80	
Coal Preparing—Operating Labour	120	
Power, Light and Water—Operating Labour	450	
Machine Shop—Foreman	50	
Operating Labour	500	
Floating Gang—Foreman	40	
Operating Labour	110	
Packing and Loading	150	
Bag Handling	180	
To Wages		7,830
(Being analysis of Payroll charges)		
Work in Process—Quarrying—		
Cement Rock—Operating Supplies	100	
,, ,, Repair Supplies	500	
Limestone—Operating Supplies	40	
Repair Supplies	20	
Work in Process—Other—		
Raw Grinding—Operating Supplies	150	
,, ,, Repair Supplies	320	
Clinker Burning—Operating Supplies	140	
Repair Supplies	490	
Clinker Grinding—Operating Supplies	120	
Repair Supplies	320	
Coal Preparing—Operating Supplies	200	
Repair Supplies	180	
Power, Light and Water—Operating Supplies	590	
Repair Supplies	270	
Machine Shop—Operating Supplies	30	
Repair Supplies	10	
Floating Gang—Operating Supplies	20	
Packing and Loading—Operating Supplies	20	
Repair Supplies	20	
Bag Handling—Operating Supplies	10	
Repair Supplies	10	
Factory Service—Repair Supplies	40	
To Stock—Supplies		3.600
(Being summary of miscellaneous supplies used)		
Work in Process—Quarrying—		
Cement Rock	400	
Limestone	50	
To Stocks—Explosives		450
(Being summary of explosives used)		

	Debit £	*Credit* £
Work in Process—Quarrying—		
Cement Rock	400	
Limestone	200	
Work in Process—Other—		
Raw Grinding	100	
Coal Preparing	4,000	
Power, Light and Water	4,000	
Machine Shop	100	
To Stocks—Coal		8,800
(Being summary of coal used)		
Work in Process - Quarrying -		
Cement Rock	30	
Limestone	30	
Packing and Loading	40	
Bag Handling	40	
Factory Service	30	
To Floating Gang		170
(Being apportionment of Floating Gang Charges)		
Work in Process—Quarrying—		
Cement Rock	30	
Work in Process—Other—		
Raw Grinding	1,400	
Clinker Burning	1,300	
Clinker Grinding	1,350	
Coal Preparing	1,080	
Machine Shop	50	
Packing and Loading	100	
Bag Handling	50	
To Power, Light and Water		5,360
(Being apportionment of Power, Light and Water charges)		
Work in Process—Quarrying -		
Cement Rock	120	
Limestone	20	
Work in Process—Other—		
Raw Grinding	200	
Clinker Burning	140	
Clinker Grinding	90	
Coal Preparing	60	
Power, Light and Water	50	
Packing and Loading	30	
Bag Handling	10	
Factory Service	20	
To Machine Shop		740
(Being apportionment of Machine Shop charged for period)		
Work in Process—Quarrying -		
Cement Rock	200	
Limestone	50	
Factory Service	2,000	
Dwelling Expense	50	
To Reserve for Depreciation—		
Quarry No. 1—Machinery		200
,, ,, 2 ,,		70
Mill Buildings		150
Mill Machinery		1,830
Huts, Sheds, etc.		50
(Being provision for Depreciation)		

	Debit £	Credit £
Work in Process—Quarrying—		
Cement Rock	50	
Limestone	20	
To Reserve for Depletion—		
Quarry No. 1		50
„ „ 2		20
(Being provision for Depletion)		
Packing and Loading	100	
To Accrued Royalties		100
(Being provision for royalties accrued due)		
Sundry Debtors	41,500	
To Cement Sales		35,000
„ Stock—New Cloth Bags		5,000
„ „ 2nd Hand Cloth Bags		250
„ „ Paper Bags		1,250
(Being sales during period)		
" X.Y.Z." Bank	34,750	
To Sundry Debtors		34,000
„ Interest		500
„ Rent of Dwellings		250
(Being summary of cash receipts during the period)		
Sundry Creditors	19,800	
Accrued Payroll	7,830	
Sundry Distribution Expenses...	930	
Sundry Office Expenses	550	
Postages and Telegrams	50	
Miscellaneous Expenses	100	
To " X.Y.Z." Bank		29,260
(Being summary of disbursements for the period)		
Second Hand Cloth Bags	4,000	
To Sundry Debtors		4,000

	Debit £	Credit £
Work in Process—Raw Grinding	3,738	
To Work in Process—		
Quarrying No. 1		2,768
„ „ 2		970
(Being work in process transferred)		
Work in Process—Other		
Clinker Grinding...	1,000	
To Stocks—		
Gypsum		1,000
(Being work in process transferred)		
Work in Process—Clinker Burning	5,640	
To Coal Preparing		5,640
(Being cost of Coal Preparing transferred)		
Work in Process—Other		
Raw Grinding	1,285	
Clinker Burning	687	
Clinker Grinding	448	
To Factory Service		2,420
(Being apportionment of Factory Service)		
Work in Process—Clinker Burning	9,343	
To Work in Process—Raw Grinding		9,343
(Being work in process transferred)		

	Debit	*Credit*
	£	£
Work in Process—Clinker Grinding	17,823	
To Work in Process—Clinker Burning		17,823
(Being work in process transferred)		
Stock—Finished Cement	24,901	
To Goods in Process— Clinker Grinding...		24,901
(Being transfer of Finished Cement)		
Cost of Sales	27,924	
To Stock—Finished Cement		27,924
(Being cost of goods sold as under :—		
90,000 barrels @ 4/- ... 18,000		
35,868 barrels @ 5/6.403 ... 9,924		

The foregoing Journal Entries would be posted to the various Ledger Accounts as follows:—

"A.B.C." BANK A/c.

July	1	To Balance	£4,500	July 31	By Balance c/d ...	£4,500
			£4,500			£4,500
Aug.	1	To Balance b/d ...	£4,500			

"X.Y.Z." BANK A/c.

July	1	To Balance	£28,000	July 31	By Cash Payments ...	£29,260
	31	,, Cash Receipts ...	34,750	31	,, Balance c/d ...	33,490
			£62,750			£62,750
Aug.	1	To Balance b/d ...	£33,490			

SUNDRY DEBTORS A/c.

July	1	To Balance	£30,500	July 31	By Returns— 2nd Hand Stocks	£4,000
	31	,, Sales	41,500	31	By Cash	34,000
				31	,, Balance c/d ...	34,000
			£72,000			£72,000
Aug.	1	To Balance b/d ...	£34,000			

BILLS RECEIVABLE A/c.

July	1	To Balance	£3,500	July 31	By Balance c/d ...	£3,500
			£3,500			£3,500
Aug.	1	To Balance b/d ...	£3,500			

MILL LAND A/c.

July	1	To Balance	£2,500	July 31	By Balance c/d ...	£2,500
			£2,500			£2,500
Aug.	1	To Balance b/d ...	£2,500			

MILL BUILDINGS A/c.

July	1	To Balance	£44,200	July 31	By Balance c/d ...	£44,200
			£44,200			£44,200
Aug.	1	To Balance b/d ...	£44,200			

MILL MACHINERY A/c.

July 1	To Balance	£110,000	July 31	By Balance c/d ...	£110,000
		£110,000			£110,000
Aug. 1	To Balance b/d ...	£110,000			

QUARRY No. 1—LAND A/c.

July 1	To Balance	£8,000	July 31	By Balance c/d ...	£8,000
		£8,000			£8,000
Aug. 1	To Balance b/d ...	£8,000			

QUARRY No. 2—LAND A/c.

July 1	To Balance	£11,400	July 31	By Balance c/d ...	£11,400
		£11,400			£11,400
Aug. 1	To Balance b/d ...	£11,400			

QUARRY MACHINERY A/c.

July 1	To Balance	£6,800	July 31	By Balance c/d ..	£6,800
		£6,800			£6,800
Aug. 1	To Balance b/d ...	£6,800			

HUTS, SHEDS, ETC. A/c.

July 1	To Balance	£2,200	July 31	By Balance c/d ...	£2,200
		£2,200			£2,200
Aug. 1	To Balance b/d ..	£2,200			

GOVERNMENT BONDS A/c

July 1	To Balance	£15,000	July 31	By Balance c/d ..	£15,000
		£15,000			£15,000
Aug. 1	To Balance b/d ...	£15,000			

PETTY CASH A/c.

July 1	To Balance	£50	July 31	By Balance c/d ...	£50
		£50			£50
Aug. 1	To Balance b/d ...	£50			

PAID UP CAPITAL A/c.

July 31	To Balance c/d ...	£200,000	July 1	By Balance	£200,000
		£200,000			£200,000
			Aug. 1	By Balance b/d ...	£200,000

PROFIT AND LOSS A/c

July 31	To Balance c/d ...	£31,696	July 1	By Balance	£26,850
			,, 31	,, Profit for Period	4,846
		£31,696			£31,696
			Aug. 1	By Balance b/d ...	£31,696

DEBENTURES A/c.

July	31	To Balance c/d ...	£40,000	July	1	By Balance	£40,000
			£40,000				£40,000
				Aug.	1	By Balance b/d ...	£40,000

SUNDRY CREDITORS' A/c.

July	31	To Cash	£19,800	July	1	By Balance	£18,000
	31	,, Balance	12,040		31	,, Purchases ...	13,840
			£31,840				£31,840
				Aug.	1.	By Balance b/d ...	£12,040

GENERAL RESERVES A/c.

July	31	To Balance c/d ...	£15,000	July	1	By Balance	£15,000
			£15,000				£15,000
						By Balance b/d ...	£15,000

BILLS PAYABLE A/c.

July	31	To Balance c/d ...	£2,000	July	1	By Balance	£2,000
			£2,000				£2,000
				Aug.	1	By Balance b/d ...	£2,000

DEPRECIATION A/c—MILL BUILDINGS.

July	31	To Balance c/d ...	£9,150	July	1	By Balance	£9,000
					31	,, Allowance ...	150
			£9,150				£9,150
				Aug.	1	By Balance b/d ...	£9,150

DEPRECIATION A/c—MILL MACHINERY.

July	31	To Balance c/d ...	£28,830	July	1	By Balance	£27,000
					31	,, Allowance ...	1,830
			£28,830				£28,830
				Aug.	1	By Balance b/d ...	£28,830

DEPRECIATION A/c—MILL LAND.

July	31	To Balance c/d ...	£500	July	1	By Balance	£500
			£500				£500
				Aug.	1	By Balance b/d ...	£500

DEPRECIATION A/c—QUARRY MACHINERY.

July	31	To Balance c/d ...	£1,670	July	1	By Balance	£1,400
					31	,, Allowance ...	270
			£1,670				£1,670
				Aug.	1	By Balance b/d ...	£1,670

DEPRECIATION A/c—HUTS, SHEDS, ETC.

July	31	To Balance c/d ...	£850	July	1	By Balance	£800
					31	,, Allowance ...	50
			£850				£850
				Aug.	1	By Balance b/d ...	£850

DEPLETION A/c—QUARRY No. 1.

July	31	To Balance c/d ...	£3,050	July	1	By Balance	£3,000
					31	,, Allowance ...	50
			£3,050				£3,050
				Aug.	1	By Balance b/d ...	£3,050

DEPLETION A/c—QUARRY No. 2.

July	31	To Balance c/d ...	£2,020	July	1	By Balance	£2,000
					31	,, Allowance... ...	20
			£2,020				£2,020
				Aug.	1	By Balance b/d ...	£2,020

CONTINGENCIES RESERVE A/c.

July	31	To Balance c/d ...	£3,000	July	1	By Balance	£3,000
			£3,000				£3,000
				Aug.	1	By Balance b/d ...	£3,000

STOCKS A/c—FINISHED CEMENT.

July	1	To Stocks	£18,000	July	31	By Sales	£27,924
,,	31	,, Work in Process	£24,901	,,	31	,, Balance c/d ...	£14,977
			£42,901				£42,901
Aug.	1	To Balance b/d ...	£14,977				

SUPPLIES A/c.

July	1	To Balance	£21,500	July	31	By Requisitions ...	£3,600
,,	31	,, Purchases ...	4,500	,,	31	,, Gypsum	1,000
				,,	31	,, Balance c/d ...	21,400
			£26,000				£26,000
Aug.	1	To Balance b/d ...	£21,400				

STEAM COAL A/c.

July	1	To Balance	£8,500	July	31	By Requisitions ...	£8,800
,,	31	,, Purchases ...	1,200	,,	31	,, Balance c/d ...	900
			£9,700				£9,700
Aug.	1	To Balance b/d ...	£900				

EXPLOSIVES A/c.

July	1	To Balance	£2,000	July	31	By Requisitions ...	£450
				,,	31	,, Balance c/d ...	1,550
			£2,000				£2,000
Aug.	1	To Balance b/d ...	£1,550				

NEW CLOTH BAGS A/c.

July	1	To Balance	£16,000	July	31	By Sales	£5,000
,,	31	,, Purchases ...	6,000	,,	31	,, Balance c/d ...	17,000
			£22,000				£22,000
Aug.	1	To Balance b/d ...	£17,000				

SECOND HAND CLOTH BAGS A/c.

July 1	To Balance	£1,500	July 31	By Sales	£250
„ 31	„ Returns Inwards	4,000	„ 31	„ Balance c/d ...	5,250
		£5,500			£5,500
Aug. 1	To Balance b/d ...	£5,250			

PAPER BAGS A/c.

July 1	To Balance	£3,400	July 31	By Sales	£1,250
„ 31	„ Purchases ...	500	„ 31	„ Balance c/d ...	2,650
		£3,900			£3,900
Aug. 1	To Balance b/d ...	£2,650			

SACKS SUSPENSE A/c.

July 1	To Balance	£6,000	July 31	By Balance c/d ...	£7,000
„ 31	„ Purchases ...	1,000			
		£7,000			£7,000
Aug. 1	To Balance b/d ...	£7,000			

WORK IN PROCESS A/c—CEMENT ROCK.

July 1	To Balance	£1,500	July 31	By Transfer to Raw Grinding ...	£2,768
„ 31	„ Superintendence	40	„ 31	„ Balance c/d ...	1,902
	„ Gen. Operating Lab.	1,300			
	„ Operating Supp.	100			
	„ Repairs Supp. ...	500			
	„ Explosives ...	400			
	„ Coal	400			
	„ Floating Gang ...	30			
	„ Power, Light and Water	30			
	„ Machine Shop	120			
	„ Depreciation ...	200			
	„ Depletion ...	50			
		£4,670			£4,670
Aug. 1	To Balance b/d ...	£1,902			

WORK IN PROCESS A/c—LIMESTONE.

July 1	To Balance ...	£500	July 31	By Transfer to Raw Grinding ...	£970
„ 31	„ Superintendence	10	„ 31	„ Balance c/d ...	470
	„ Gen. Op. Labour	500			
	„ Operating Supp.	40			
	„ Repair Supp. ...	20			
	„ Explosives ...	50			
	„ Coal	200			
	„ Floating Gang ...	30			
	„ Machine Shop ...	20			
	„ Depreciation ...	50			
	„ Depletion ...	20			
		£1,440			£1,440
Aug. 1	To Balance b/d ...	£470			

WORK IN PROCESS A/c—RAW GRINDING.

July 1	To Balance ...	Nil	July 31	By Transfer to Clinker Burning... ...	£9,343
„ 31	„ Gen. Op. Labour	2,150			
	„ Operating Supp.	150			
	„ Repair Supp. ...	320			
	„ Coal	100			
	„ Power, Light and Water	1,400			
	„ Machine Shop ...	200			
	„ Factory Service	1,285			
	„ Cement Rock ...	2,768			
	„ Limestone ...	970			
		£9,343			£9,343

WORK IN PROCESS A/c—CLINKER BURNING.

July 1	To Balance	Nil	July 31	By Transfer to Clinker Grinding ...	£17,823
„ 31	„ Gen. Operating Labour ...	£1,150	„	„ Balance c/d ...	1,067
	„ Op. Supplies ...	140			
	„ Repair Supplies	490			
	„ Power, Light and Water	1,300			
	„ Machine Shop	140			
	„ Factory Service	687			
	„ Coal Preparing ...	5,640			
	„ Raw Grinding ...	9,343			
		£18,890			£18,890
Aug. 1	To Balance b/d ...	£1,067			

WORK IN PROCESS—CLINKER GRINDING A/c.

July 1	To Balance	£3,000	July 31	By Transfer to Finished Cement ...	£24,901
„ 31	„ Gen. Operating Labour ...	750			
	„ Operating Supp.	120			
	„ Repair Supplies	320			
	„ Power, Light and Water	1,350			
	„ Machine Shop	90			
	„ Factory Service	448			
	„ Clinker Burning	17,823			
	„ Gypsum ...	1,000			
		£24,901			£24,901

FACTORY SERVICE A/c.

July 31	To Superintendence	£50	July 31	By Raw Grinding ...	£1,285
	„ Office & Stores	200		„ Clinker Burning ...	687
	„ Laboratory ...	80		„ Clinker Grinding...	448
	„ Repair Supplies...	40			
	„ Floating Gang ...	30			
	„ Machine Shop ...	20			
	„ Depreciation ...	2,000			
		£2,420			£2,420

COAL PREPARING A/c.

July 31	To Operating Labour	£120	July 31	By Clinker Burning ...	£5,640
	„ Operating Supplies	200			
	„ Repair Supplies	180			
	„ Coal	4,000			
	„ Power, Light and Water	1,080			
	„ Machine Shop ...	60			
		£5,640			£5,640

POWER, LIGHT AND WATER A/c.

July 31	To Operating Labour	£450	July 31	By Transfers ...	£5,360
	„ Operating Supp.	590			
	„ Repair Supplies	270			
	„ Coal	4,000			
	„ Machine Shop	50			
		£5,360			£5,360

MACHINE SHOP A/c.

July 31	To Foreman ...	£50	July 31	By Transfers ...	£740
	„ Operating Labour	500			
	„ Operating Supp.	30			
	„ Repair Supplies	10			
	„ Coal	100			
	„ Power, Light and Water	50			
		£740			£740

FLOATING GANG A/c.

July 31	To Foreman ...	£40	July 31	By Transfers	£170
	„ Labour	110			
	„ Operating Supp.	20			
		£170			£170

PACKING AND LOADING A/c.

July 31	To Wages	£150	July 31	By P. & L. A/c ...	£460
	„ Floating Gang	40			
	„ Power, Light and Water	100			
	„ Machine Shop ...	30			
	„ Royalties ...	100			
	„ Operating Supplies	20			
	„ Repair Supplies...	20			
		£460			£460

SACK HANDLING A/c.

July 31	To Wages	£180	July 31	By P. & L. A/c ...	£300
	„ Operating Supp.	10			
	„ Repair Supplies	10			
	„ Floating Gang ...	40			
	„ Power, Light and Water	50			
	„ Machine Shop ...	10			
		£300			£300

DWELLING EXPENSE A/c.

July 31	To Depreciation ...	£50	July 31	By P. & L. A/c ...	£50

ACCRUED ROYALTIES A/c.

July 31	To P. & L. A/c ...	£100	July 31	By Packing and Loading Charges ...	£100

ACCRUED PAYROLL A/c.

July 31	To Wages Paid ...	£7,830	July 31	By Wages Due ...	£7,830

WAGES A/c.

July 31	To Wages Due ...	£7,830	July 31	By Transfers	£7,830

PRINTING AND STATIONERY A/c.

July 31	To Purchase... ...	£100	July 31	By P. & L. A/c ...	£100

RENT A/c.

July 31	To Accruals ...	£50	July 31	By P. & L. A/c ...	£50

SUNDRY OFFICE EXPENSES A/c.

July 31	To Purchases ...	£150	July 31	By P. & L. A/c ...	£700
	„ Cash	550			
		£700			£700

COST OF SALES A/c.

July 31	To Sales	£27,924	July 31	By P. & L. A/c ...	£27,924

CEMENT SALES A/c.

July 31	To P. & L. A/c ...	£35,000	July 31	By Sundry Debtors ...	£35,000

INTEREST A/c.

July 31	To P. & L. A/c ...	£500	July 31	By Cash	£500

RENT OF DWELLINGS A/c.

July 31	To P. & L. A/c ...	£250	July 31	By Cash	£250

SUNDRY DISTRIBUTION EXPENSES A/c.

July 31	To Cash	£930	July 31	By P. & L. A/c ...	£1,270
	„ Purchases ...	340			
		£1,270			£1,270

POSTAGES AND TELEGRAMS A/c.

July 31	To Cash	£50	July 31	By P. & L. A/c ...	£50

MISCELLANEOUS EXPENSES A/c.

July 31	To Cash	£100	July 31	By P. & L. A/c ...	£100

The Costs of the various processes would be shown on Process Cost Sheets as follows:—

PROCESS COST No. 1.

Process—Quarrying No. 1.
Product—Cement Rock.
Period—July, 194–.

Unit Cost.
This Process—2/6.432.
Prior Process—Nil.

194–		*Material*	*Labour*	*Factory Service*
July 31	Superintendence			40
	Operating Labour		1,300	
	Operating Supplies			100
	Repair Supplies...			500
	Explosives			400
	Coal			400
	Floating Gang			30
	Power, Light and Water			30
	Machine Shop			120
	Depreciation			200
	Depletion	50		
		£50	£1,300	£1,820

Total—£3,170 for 25,000 tons—2/6.432 per ton.

Work in Process from Previous Period—10,000 tons—Value—£1,500 (Unit Value—3/–).
Charges in Current Period—as above—

Materials	50	
Labour	1,300	
Overhead	1,820	
Total Value	£4,670	
Closing Stock—15,000 tons at Unit Value—2/6.432 (as above)	£1,902	
Stock Transferred—20,000 tons	£2,768	(unit Value 2/9.216).

PROCESS COST No. 2.

Process—Quarrying No. 2.
Product—Limestone Rock.
Period—July, 194—.

Unit Cost.
This Process—1/2.1 per ton.
Prior Process. Nil.

194–		*Material*	*Labour*	*Factory Service*
July 31	Superintendence			10
	Operating Labour		500	
	Operating Supplies			40
	Repairs Supplies			20
	Explosives			50
	Coal			200
	Floating Gang			30
	Machine Shop			20
	Depreciation			50
	Depletion	20		
		£20	£500	£420

Total—£940 for 16,000 tons—1/2.1 per ton.

Work in Process from Previous Period—8,000 tons—£500 (unit value 1/3).
Charges in Current Period—as above—

Materials	£20	
Labour	500	
Overhead	420	
	£1,440	
Closing Stock—8,000 tons at 1/2.1—	470	
Stock Transferred	£970	(Unit Value—1/2.55).

PROCESS COST No. 3.

Process—Raw Grinding.
Period—July, 19–.

Unit Cost.
This Process 1/4.815d.
Prior Process 11.214d.

19–		*Material*	*Labour*	*Factory Expense*
July	Operating Labour		2,150	
	Operating Supplies			150
	Repair Supplies...			320
	Coal			100
	Power, Light and Water			1,400
	Machine Shop			200
	Cement Rock—transferred from Process 1 ...	2,768		
	Limestone Rock—transferred from Process 2	970		
	Factory Service...			1,285
		£3,738	£2,150	£3,455

Total—£9,343 for 80,000 barrels—2/4.029 per barrel.

Charges in current period—		
Material	£3,738	
Labour	2,150	
Overhead	3,455	
		£9,343

Work in Process from Previous Period—	Nil
Quantity Processed—	80,000 barrels
Total in Process—	Nil
Total transferred to Clinker Burning	80,000 barrels
Total left in Stock—	Nil

PROCESS COST No. 4.

Process—Clinker Burning.
Period—July 194—

Unit Cost.
This Process ... 2/5.004
Previous Process 2/4.029

		Material	*Labour*	*Factory Expense*
July 194–	Operating Labour		1,150	
	Operating Supplies			140
	Repair Supplies			490
	Power, Light and Water			1,300
	Machine Shop			140
	Coal Preparing			5,640
	Transferred from Raw Grinding—80,000 barrels @ 2/4.029	9,343		
	Factory Service			687
		9,343	1,150	8,397
	Total	£18,890		

Work in Previous Period—Nil.
Quantity Processed—75,000 barrels.
Quantity in Process—Uncompleted—5,000 barrels.
Quantity transferred to Clinker Grinding—75,000 barrels.

Work in Process— Equivalent Performance	*Partly Processed*	*Finished Work Fully Processed*	*Total Processed*
Materials—100%	5,000 barrels	75,000 barrels	80,000 barrels
Labour—80%	4,000 "	75,000 "	79,000 "
Expense—80%	4,000 "	75,000 "	79,000 "

Materials, 80,000 barrels cost £9,343 — Unit Cost 2/4.029d.
Labour 79,000 " " £1,150 — " " 3.494d.
Expense 79,000 " " £8,397 — " " 2/1.510d.

Cost of Fully Processed Work—

Materials,	**75,000**	**barrels**	**@ 2/4.029d.**	**—**	**£8,759**	
Labour,	**75,000**	**,,**	**@ 3.494d.**	**—**	**£1,092**	
Expense,	**75,000**	**,,**	**@ 2/1.510d.**	**—**	**£7,972**	
					Total	**£17,823**

Cost of Partly Processed Work—

Materials,	**5,000**	**barrels**	**@ 2/4.029d.**	**—**	**£584**	
Labour,	**4,000**	**barrels**	**@ 3.494d.**	**—**	**£58**	
Expense.	**4,000**	**barrels**	**@ 2/1.510d.**	**—**	**£425**	
					Total	**£1,067**
						£18,890

Transferred to Clinker Grinding—75,000 barrels, Cost, £17,823

PROCESS COST No. 5.

Process—Clinker Grinding.

Period—July, 194–.

Unit Cost.

This Process ...	1/0.671
Previous Process ...	4/9.033

		Material	*Labour*	*Factory Expense*
July 194–	Operating Labour		750	
	Operating Supplies			120
	Repair Supplies			320
	Power, Light and Water			1,350
	Machine Shop			90
	Transferred from Clinker Burning—75,000 barrels @ 4/9.033	17,823		
	Factory Service			448
	Gypsum	1,000		
		£18,823	£750	£2,328

Work in Process—

Equivalent Performance	*Opening Process*	*Processed During Period*
Materials, 100%	15,000 barrels	nil
Labour, 80%	12,000 ,,	3,000 barrels
Expense, 80%	12,000 ,,	3,000 ,,

Processed During Period—

Opening Work in Process	*Fully Processed*	*Total Processed*
Materials, nil	75,000 barrels	75,000 barrels
Labour, 3000 barrels	75,000 ,,	78,000 ,,
Expense, 3000 ,,	75,000 ,,	78,000 ,,

Processed Cost—

Materials,	75,000 barrels	£18,823	Unit Cost 5/0.234d.
Labour,	78,000 ,,	750	2.308d.
Expense,	78,000 ,,	2,328	7.163d.
	Previous Cost (Opening Work in Process)	3,000	
Transferred to Finished Cement	**90,000 barrels**	**£24,901**	**5/6.403d.**

A Trial Balance prepared in relation to the foregoing Ledger Accounts would be as follows:—

PRELIMINARY TRIAL BALANCE AS AT 31ST JULY, 19—.

"A.B.C." Bank	4,500	
"X.Y.Z." Bank	33,490	
Sundry Debtors	34,000	
Bills Receivable	3,500	
Mill Land	2,500	
Mill Buildings	44,200	
Mill Machinery	110,000	
Quarry No. 1—Land	8,000	
Quarry No. 2.—Land	11,400	
Quarry Machinery	6,800	
Huts, Sheds, etc.	2,200	
Government Bonds	15,000	
Petty Cash	50	
Paid Up Capital		200,000
Profit and Loss		26,850
Debentures		40,000
Sundry Creditors		12,040
General Reserves		15,000
Bills Payable		2,000
Depreciation—Mill Buildings		9,150
„ —Mill Machinery		28,830
„ —Mill Land		500
„ —Quarry Machinery		1,670
„ —Huts, Sheds, etc.		850
Depletion—Quarry No. 1		3,050
„ „ No. 2		2,020
Contingencies Reserve		3,000
Stocks Finished Cement	14,977	
Supplies	21,400	
Coal	900	
Explosives	1,550	
New Cloth Bags	17,000	
Second Hand Cloth Bags	5,250	
Paper Bags	2,650	
Sacks Suspense A/c.	7,000	
Printing and Stationery	100	
Rent	50	
Sundry Office Expenses	700	
Packing and Loading	460	
Sack Handling	300	
Dwelling Expense	50	
Accrued Royalties		100
Cement Sales		35,000
Interest		500
Rent of Dwellings		250
Sundry Distribution Expenses	1,270	
Postages and Telegrams	50	
Miscellaneous Expenses	100	
Work in Process—Cement Rock	1,902	
Limestone	470	
Clinker Burning	1,067	
Cost of Sales	27,924	
	£380,810	£380,810

The following Closing Journal Entries would be necessary:—

		Debit	Credit
Cement Sales		£35,000	
To Profit and Loss A/c			£35,000
(Being transfer)			
Profit and Loss A/c		27,924	
To Cost of Sales			27,924
(Being transfer)			
Profit and Loss A/c		2,990	
To Packing and Loading			460
„ Sack Handling			300
„ Distribution Expenses			1,270
„ General Expenses—			
Dwelling Expense	£50		
Print. and Stat.	100		
Sundry Office Exs.	700		
Post and Telegrams	50		
Miscellaneous Exs.	100		
			1,000
(Being Sundry Transfers)			
Accrued Royalties		100	
Interest		500	
Rent of Dwellings		250	
To Profit and Loss A/c			850
(Being Sundry Transfers)			
Profit and Loss A/c		50	
To Rent			50
(Being transfer)			

The Profit and Loss Account would then appear as hereunder:—

PROFIT AND LOSS ACCOUNT.

Cement Sales		£35,000
Less Cost of Sales		27,924
Gross Profit on Sales		£7,076
Deduct Expenses—		
Packing and Loading	£460	
Sack Handling	300	
Distribution Exs.	1,270	
General Expenses	1,000	
Total Operating Expenses	£3,030	
		3,030
Net Operating Profit		£4,036
Plus—Non-Operating Income	£850	
Less—Non-Operating Expense	50	
		800
Net Income for Month		£4,836

CHAPTER 16.

COST ACCOUNTING PROCEDURE — BY-PRODUCT COSTS AND JOINT PRODUCTS.

Waste is generally due to one of two causes:—

(a) Disappearance of material in manufacturing processes.

(b) Shrinkage in value of the original substance entering the process.

It should be noted that values or qualities can disappear without any disappearance on the part of the material. Furthermore, a substance can be left, but it may have either less value than the original material or no value at all.

Definitions.

Spoildge.

Spoilage is the loss resulting from accidental destruction of value in work in process. It not only means a loss in value as far as the material of the product is concerned (such as waste), but also a loss of amounts expended for labour and factory expense. It is sometimes possible to salvage spoiled work and put it back into work in process. In this case spoilage is the cost of salvaging and bringing the work back to that point at which it had arrived previously.

Scrap.

This is represented by materials remaining after a portion has been taken. For example, the cutting of materials from large sheets might leave small irregular pieces. If these have some value they are scrap, the loss of value in such a case being waste. Scrap is an asset, but is of smaller value than the material from which it was derived.

There is generally a great deal of loose terminology employed in connection with the foregoing. Waste is very often referred to as covering waste, spoilage and scrap. This may not be very serious as long as a clear understanding of what is involved is held.

By-Products.

Some products are manufactured, and in the course of manufacture portions of the original material may split off and never again become part of the main product. If the value of such material is quite small as compared to the main product, it is usually referred to as scrap. If, however, the relative value is not small and there is a fairly steady market for it, it can be called a by-product. There is however, some confusion about this definition, and the term "by-product" is often confined to products resulting from further processing of the split off material. If the material is saleable without further processing it is often called scrap.

Joint Products.

There are many manufacturing processes where two or more products are made at the same time from the same material, and, without having exactly the same values, are sufficiently important to be treated as joint products. Probably the three best-known industries affected by joint products are the oil, meat packing, and sawmilling industries.

ACCOUNTING TREATMENT.

1. Waste and Spoilage.

Very often no special accounting is necessary. In the case of loss of iron by burning in the cupola, for example, the number of pounds of molten iron poured into the moulds is reduced and the cost of all the iron is placed against the total of the costs of the smaller, but normal, number of pounds poured. Sometimes a standard rate for waste is used. In such a case, the entry would be inserted debiting the normal waste to the Process Account and crediting to Melting Cost Account. Where waste or spoilage has been excessive, the excess may be shown (so as to draw attention) by a credit to the Manufacturing Account and a debit to an Excess Waste and Spoilage Account.

Where income is received from the sale of scrap and waste material, the amount received is generally credited to Miscellaneous Income or an account specially opened for the purpose, indicating the precise nature of the income. For example, quantities of sawdust, though sometimes sold, would not be given any stock value. When sold, the income would be treated:—

Cash (or Sundry Debtors) Dr.	
To Sawdust Sales	Cr.

2. Spoilage.

When waste arises from defective work or defective material in parts which have had work done on them, and therefore amount to some appreciable value, a waste or spoilage ticket should be made out showing the full particulars of materials damaged, the stage they had reached when spoiled, and cause of their rejection. The cost value of the spoiled parts would be computed as well as the scrap value, and this would be used for a journal entry as under:—

Loss from Spoilage	£5	
Scrap Metal Stores	£1	
To Work in Process		£6

This would mean that the value of the spoiled goods would be included in the store at £1.

3. By-Products.

Reference has already been made to what is usually interpreted as a by-product. In some types of manufacture at a certain stage, certain products are released from the main stream of manufacture. These are not as important as the main product, and may be saleable either in the state in which they are released from the main manufacturing process or after some further manufacturing process carried out specifically in relation to the by-products. It is necessary to consider the accounting treatment to be given. Three methods will be considered, as different circumstances may require different treatment.

First Method.—Where the value of by-products is small and relatively unimportant, the amount received from the sale thereof may be treated in the accounts as Other Income. This would mean that the total costs of manufacture are treated as being as applicable to the main product or products, and the value received from the sales of by-products would appear in the Profit and Loss A/c. under the heading of Other Income. This is strictly speaking not correct, because it may well be argued that part of the cost of manufacturing should be applied to the by-product. If the amount is small, however, it may not be worth the trouble of apportioning costs between the main products and by-products, especially as any basis thus adopted would be of a most arbitrary kind. Stocks would usually appear in stock lists at "no value." The accounting entry involved would be:—

Cash Dr.
To Other Income Cr.

Second Method.—If the amount received from the sale of by-products is not small, it would be necessary to make some adjustments in relation to the cost of the main products produced. Thus, the value of main products might be £5,000 and the value of by-products £800. Obviously, the cost of producing £800 worth of by-products is included in the total manufacturing cost, and under the first method this would be ignored This second method proceeds on the assumption that the primary purpose is to produce the main products, and therefore any revenue which is received for by-products should be used to reduce the manufacturing cost of the main products. If, therefore, the total cost of production of 1,100 tons of a commodity was £2,450, and sales of by-products totalled £250, the cost of the main product would be arrived at as under:—

Total Cost of Production ..	£2,450
Less Sales of By-Products ..	250
Net Cost of Production	£2,200
Total Weight Produced	1,100 tons
Cost per ton	£2

This method also has the virtue of simplicity, but the position becomes more complicated if all the stock of by-products is not sold within the financial period. In such a case, there is a choice of placing no value upon the stock of by-products held, or, alternatively of allocating a value to such stock and making an adjustment accordingly. If the stock at the beginning and end of any period is usually uniform in quantity, there is probably little advantage in placing a value upon such stocks. If, however, such stocks fluctuate considerably, it may be necessary to arrive at a value. As will be seen later in this Chapter, there are methods of arriving at the value of Joint Products, and one of such methods could be adopted in the case of by-products if thought advisable. If, however, there is no desire to go to any lengthy process to adjust the values, all that may be necessary is to arrange for a valuation upon some arbitrary basis. For example, if there were 250 units of by-product, which it was felt would probably realise £1 per unit, it may be decided to place a value of 10/- or 15/- per unit for stocktaking purposes. Another method is to estimate, firstly, the price likely to be realised, which in this case would be £1 per unit, and deduct therefrom the estimated amount of selling expense involved in selling the by-product. If this was calculated as being approximately 2/6 per unit, the value of the stock would be shown at 250 units at 17/6 per unit. If no by-products had been sold during the period, the position would be set out as under:—

Total Cost of Production		£2,450 0 0
Less Stock of By-Products		
Estimated Selling price, 250 at £1 ..	£250 0 0	
Less Estimated Selling Expenses—250 @ 2/6	31 5 0	218 15 0
Net Cost of Production		£2,231 5 0

It would usually be found that portion of the by-products had been sold and portion was held in stock. This position could be shown:—

Total Cost of Production		£2,450 0 0
Less Sales of By-Products		200 0 0
		£2,250 0 0
Less Estimated Value of stock of by-products	£50 0 0	
Estimated Selling Expenses, 50 @ 2/6 ..	6 5 0	43 15 0
Total Cost of Production		£2,206 5 0

This method has the advantage over the first method of arriving at the actual cost of the product manufactured.

The accounting entries to give effect to the foregoing would be:—

Cash Dr.
To By-Product Sales Cr.
(Being amount received from by-products sold.)

By-Product Sales Dr.
To Manufacturing Expense Control A/c.
(Being deduction from Manufacturing Expense to cover cost of By-Product Sales).

The accounting entries for the stock on hand would be:—

Stock on Hand By-Products Dr.
To Reserve for Selling Expense Cr.
Estimated Sales of By-Products Cr.
(Being estimated value of stock of by-products at selling prices, with reserve for estimated selling expense.)

When the stock was finally sold, the entry would be reversed, viz.:—

Reserve for Selling Expense Dr.
Estimated Sales of By-Products Dr.
To Stock on Hand—By Products Cr.
(Being sales of by-product stocks.)

Cash Dr.
To By-Product Sales
(Being amount received from by-products sold.)

Third Method.—Sometimes it is necessary to carry out further manufacturing process upon by-products, after the split-off from the main products. Here again there may be a fine distinction only between by-products and joint-products. If, however, it is desired to retain the treatment as by-products, so that the deduction of the value of the by-products can be made from total costs of production of the main product, it is necessary to arrive at a formula which will enable a valuation to be reached. The following statement sets out how such a valuation can be obtained :—

Cost of By-Products

Sales of By-Products			£5,000
Less Cost of Production after split-off—			
Materials	£500		
Labour	1,000		
Expense	500		
		2,000	
Selling and Administration		200	2,200
Net Yield from By-Products			£2,800

Cost of Main Product

Costs before Split-off—		
Materials	15,000	
Labour	20,000	
Expense	15,000	
Total Cost before Split-off		£50,000
Less Net Yield from By-Products		2,800
Net Cost at time of Split-off		£47,200
Add costs of Main Product after Split-off—		
Materials	2,000	
Labour	8,000	
Expense	6,000	16,000
Total Manufacturing Cost		£63,200

The accounting entries in this case are similar to those outlined in the Second Method. Other terms are sometimes used in place of "split off" as, for example, "point of separation."

4. Joint Products.

As in the case of by-products, when products are produced jointly it would be seldom that any true cost for each could be arrived at. There are generally no separate costs for the several products. The total cost would be known, but it is always difficult to arrive at a just separation of the total cost amongst the various products. If there are no stocks on hand at the end of the period, it may not be necessary to make allocations of cost. Similarly, if the quantities of stocks at the end of the period are exactly in ratio to the production and there have been no changes in market prices, allocations of costs to individual products can be dispensed with. Whenever allocations to joint products are made, the purpose in all cases should be the reasonable evaluation of stocks or costs of sales.

For the first example it is proposed to take a sawmill producing selected boards, merchantable boards, shorts, scantlings and facecuts.

First Method.—This simply involves taking the total amount of timber produced during a month and dividing it by the total output of sawn timber. This would then give the total cost of each 100 super feet of sawn timber calculated. This is not recommended except under certain very exceptional circumstances, because it makes no attempt to distinguish between the various grades or sizes of timber produced. Obviously, it would be absurd to include a commodity such as face-cuts in final figures of production, even though some mills may have a permanent market for such. The costing figures taken from these figures would mean that the sawmiller was under-estimating his costs on good timber and overestimating those on face-cuts. (See Figure No. 72.)

FIGURE No. 72.

JOINT PRODUCTS.

FIRST METHOD OF COSTING.

	Total	Logging	Hauling	Trucking	Milling	Stacking
Wages—						
Direct	£131 10 8	£22 7 3	£24 8 2	£8 9 5	£49 15 6	£26 10 4
Indirect	37 18 10	8 4 9	3 9 6	5 2 1	12 18 2	8 4 4
Expenses—						
Direct	34 17 5	2 1 9	12 8 2	1 18 6	14 2 10	4 6 2
Indirect	21 5 4	3 6 2	4 9 5	2 10 3	7 1 1	3 18 5
	£225 12 3	£35 19 11	£44 15 3	£18 0 3	£83 17 7	£42 19 3

	Total	Logging	Hauling	Trucking	Milling	Stacking
No. of Super. Feet Sawn Timber Cut—74,500						
No. of Super. Feet Round Measurement Logs—110,000						
Cost per 100 s. ft. Round Measurement		8d.	10d.	4d.		
Cost per 100 s. ft. Sawn Timber	6/-	11½d.	1/2	5¾d.	2/3	1/1¾
Plus Royalty	1/-					
Total Milling Cost	7/-					

Second Method.—This is one in which the procedure is directed towards valuing the products at first in the aggregate, and then proceeding to distinguish between them on the basis of market price. It may be just as well to point out at the outset that, before criticising these methods, it is essential to note that the actual information to guide one is—

1. The cost of the raw material, which is practically solely the royalty cost.
2. The total operating costs divided between the milling and the kiln drying activities.
3. The yield of each individual grade of timber over the period.
4. The market value of the products.

Proceeding with this information, therefore, it is necessary to take the market value of the actual production of each grade or classification of timber during the costing period and obtain its percentage of the total market value of all the products. The percentage arrived at is then applied to the costing figures and the result obtained is taken as the cost of each particular line of product.

This method overcomes most of the disadvantages of the previous method, and, though it is open to certain other disadvantages, it is largely used. Its value lies in the fact that it seeks to discriminate in cost between the poor timber and the selected, and, as this is essential, it has much merit. It also overcomes the serious objection of stock on hand values, which can be urged against the previous method. Sometimes it happens, however, that with a long costing period and constant fluctuations in market values, considerable confusion may result. In addition, in order to get a true perspective of the market position, the value of timber at the mill must be arrived at, allowance being made for transport. Of additional importance, however, and representing one of the main drawbacks to the method, is the fact that market value is not the only factor which should be taken into account when arriving at the individual costs. It is certainly the main factor, but there are other technical considerations which have some bearing on the question. It is well known that, because of the need for what is known as "quarter sawing," board production greatly slows up production. Whereas the normal output of a sawmill might be 10,000 super feet of timber daily, providing that only scantlings are cut, it may be capable of cutting only 8,000 super feet when the maximum number of boards are produced, especially when slow sizes such as 7 x ¾ are required. In addition, whereas scantlings can be cut to a neat or comparatively neat size, boards must be given room for a certain amount of contraction in the drying process, and they therefore have to be cut oversize. It seems only right, therefore, that such factors should be taken into consideration when arriving at cost values. Board cutting also increases the number of shorts which are sold at a lower value, and there are also other technical considerations to be taken into account. It is with the idea of meeting these conditions that the third method has been evolved. (See Figure No. 73.)

FIGURE No. 73.
JOINT PRODUCTS.
SECOND METHOD OF COSTING.

Week Ending	Total Cost of Sawn Timber	Selected Boards	Merchantable Boards	Scantlings	Face-Cuts	Total Selling Value
	£ s. d.	S. Ft.				£ s. d.
14th July, 1934— Weekly Output of Sawn Timber—74,500 sup. ft.	225 12 3	22,000 @ 20/-	31,000 @ 18/-	16,000 @ 12/6	5,500 @ 4/-	220 0 0 279 0 0 100 0 0 11 0 0
Total Selling Value						£610 0 0
Cost of Selected Boards— 220 × £225/12/3 div. by 220 —— 610		7/5				
Cost of Merchantable Boards— 279 × £225/12/3 div. by 310 —— 610			6/8			
Cost of Scantlings— 100 × £225/12/3 div. by 160 —— 610				4/7½		
Cost of Face-Cuts— 11 × £225/12/3 div. by 55 —— 610					1/5¾	

Third Method.—This consists of arriving at a standard product, with which the other products are compared and reduced to a percentage. This system allows the whole of the factors previously mentioned to be taken into account, including types of products, peculiarities in individual pro-

ductions, long lengths against shorts, and any other matters which may in certain cases be peculiar to a sawmill, or to timber being cut. It is, of course, essential to arrive at the reducing factor, as it is termed, only after a very thorough examination of the whole of the factors that affect it. It is useless to adopt a haphazard method—indeed this is the main drawback of this plan—as incorrect results could quite easily be shown. It can be said that the correctness of the individual costs depend upon the correctness of the reducing factor, and this may be regarded as dangerous, but it must be remembered that the fact that the costs cannot be arrived at by a method that permits of absolute accuracy is an argument which can be advanced against any method once the first method referred to above is passed over. In any case, it must also be remembered that the accuracy of the total of the costs in the first place depends upon the accuracy of correct dissections, apportionments and tallies. (See Figure No. 74.)

FIGURE No. 74
JOINT PRODUCTS.
THIRD METHOD OF COSTING.

	Total Cost of Sawn Timber	Particulars of Weekly Output s. ft.	Reducing Factor	No. of Units	Cost Price Calculation	Cost Price
Cost of Sawn Timber Boards Selected	£225 12 3	20,000	100%	20,000	$\frac{20000}{64375}$ × £225/12/3 ÷ 200	7/0½
Boards Merchantable		30,000	95%	28,500	$\frac{28500}{64375}$ × £225/12/3 ÷ 300	6/8
Scantlings		15,000	75%	11,250	$\frac{11250}{64375}$ × £225/12/3 ÷ 150	5/3
Shorts—1sts		3,000	82.5%	2,575	$\frac{2575}{64375}$ × £225/12/3 ÷ 30	6/1
Shorts—2nds		1,000	67.5%	675	$\frac{675}{64375}$ × £225/12/3 ÷ 10	4/8¾
Face-Cuts		5,500	25%	1,375	$\frac{1375}{64375}$ × £225/12/3 ÷ 55	1/9
	£225 12 3	74,500 s. ft.		64,375		

Certain other problems arising in the case of Joint Products are encountered when a different type of illustration is taken.

A man purchases £6,000 worth of a mixture, which he proceeds to grade and finally he finds that he has on hand the following:—

12,000 first grade,
5,000 second grade,
3,000 third grade.

He then proceeds to sell these at a price of 10/- for 1st grade, 8/- for 2nd, and 6/- for 3rd. His total proceeds are therefore £8,900, and he knows that he has made £2,900 profit. In such a case there is no need for any further calculations. The merchant knows his total cost, and his total sales realisations.

The position may not be quite as simple, however, if at the end of the financial period he has on hand unsold:—

2,000 cases first grade,
500 cases second grade,
500 cases third grade.

He has sold all the balance at 10/-, 8/- and 6/- respectively, but at the end of the period the market prices are 12/-, 9/- and 7/- respectively. The problem is to decide upon the value for each grade in connection with the stock held. This can be done in one of three ways:—

First Method.—An arbitrary value can be placed upon each grade, having in mind the amount likely to be realised and the selling expenses involved. This is similar to the method suggested in connection with by-products. It is not very suitable, however, where large sums are involved.

Second Method.—A calculation should first of all be made to see what the sales value realised would be if the stock on hand could be sold on stock-taking day at the existing market price. This is shown hereunder:—

First Grade.						
Sold —10,000	cases	@	10/-	£5,000	
Stock— 2,000	„	„	12/-	1,200	£6,200
Second Grade.						
Sold — 4,500	cases	@	8/-	1,800	
Stock— 500	„	„	9/-	225	2,025
Third Grade.						
Sold — 2,500	cases	@	6/-	750	
Stock— 500	„	„	7/-	175	925
Total Sales Value					£9,150

The second step is to compute the total cost as a percentage of the total sales value, viz.:—

£6,000 divided by £9,150 = 65·6%

This percentage is then allocated to the stocks held, viz.

First Grade	65·6%	of	£1,200	—	£788
Second Grade	65 6%	„	£225	—	148
Third Grade	65 6%	„	£175	—	115
Assumed Cost of Stocks					£1,051

Third Method.—This proceeds further than the second method, and is really a continuation of it. Having arrived at the figure shown above, a computation is made allocating the costs to each product, viz.:—

First Grade	65·6%	of	£6,200	—	£4,066
Second Grade	65·6%	„	£2,025	—	1,327
Third Grade	65·6%	„	£925	—	607
Total Cost					£6,000

The total cost of each grade thus obtained is then divided by the number of cases of each grade, viz.:—

£4,066	divided	by	12,000	cases	of	First Grade	—	6/9¼	per case.
1,327	„	„	5,000	„	„	Second „	—	5/3½	„ „
607	„	„	3,000	„	„	Third „	—	4/0½	„ „

The results are the average costs allocated to each grade, and these are used to arrive at the costs of stock held:—

2,000	@	6/9¼	First Grade	—	£677	1	8
500	„	5/3½	Second „	—	132	5	10
500	„	4/0½	Third „	—	101	0	10
			Assumed Cost of Stocks		£910	8	4

It will be seen from the foregoing that under the Second Method, the cost allocated to the stocks held was £1,051, and under the Third Method £910/8/4. Usually the Third Method would give a more accurate result, but the exact method to be adopted depends upon the circumstances of each case.

The difference between the second and third methods can be more clearly understood where the market price of one product increases, whilst another decreases. This is shown below :—

Assume that at the end of the period, the market prices are :—

First Grade—12/-.
Second Grade—8/-.
Third Grade—5/-.

The total Sales Value would therefore be :—

First Grade.					
Sold —	10,000	@	10/-	£5,000	
Stock—	2,000	„	12/-	1,200	£6,200
Second Grade.					
Sold —	4,500	@	8/-	1,800	
Stock—	500	„	8/-	200	2,000
Third Grade.					
Sold —	2,500	@	6/-	750	
Stock—	500	„	5/-	125	875
			Total Sales Value		£9,075

This gives a percentage on Sales Value of 66·1% (£6,000 divided by £9,075).

Allocated to stocks held the value would be :—

First Grade	—	66·1%	of £1,200	—	£793
Second Grade	—	66·1%	„ £200	—	132
Third Grade	—	66·1%	„ £125	—	83
		Assumed Cost of Stocks			£1,008

Allocating these costs to each product:—

First Grade	—	66·1%	of £6,200	—	£4,099
Second Grade	—	66·1%	of £2,000	—	£1,322
Third Grade	—	66·1%	of £875	—	579
		Total Cost			£6,000

The cost of each grade is therefore :—

First Grade —£4,099 divided by 12,000 cases—6/10 per case.
Second Grade —£1,322 divided by 5,000 cases—5/3½ „ „
Third Grade — £579 divided by 3,000 cases—3/10¼ „ „

These average costs used to obtain the costs of stock show the following results :—

First Grade	—	2,000	@ 6/9¾	per case	—	£683	6	8
Second Grade	—	500	„ 5/3½	„ „	—	132	5	10
Third Grade	—	500	„ 3/10¼	„ „	—	96	7	1
				Assumed Cost of Stocks		£911	19	7

In this case the value allocated to stock under the Second Method was £1,008, and under the third method £911/19/7. A more interesting comparison is obtained, however, between the grades:—

	Second Method.	*Third Method.*		
First Grade	£793	£683	6	8
Second Grade	132	132	5	10
Third Grade	83	96	7	1

Without giving the detailed workings it can be indicated that if the market prices of the various grades on Stocktaking day were:—

First Grade	12/-
Second Grade	12/-
Third Grade	5/-

the assumed value of stocks under the Second and Third Methods would be:—

	Second Method.	*Third Method.*		
First Grade	£785	£677	1	8
Second Grade	196	137	10	0
Third Grade	82	95	6	3

It will be seen from the foregoing that the increased market value of the Second Grade has shown up considerably in the Second Method, whilst the Third Method shows little difference. The reason is, of course, that any increase in value is spread more directly amongst the stock on hand in the Second method, but amongst all the cases bought in the Third Method.

The foregoing are the usual methods of dealing with Joint Products. No particular way need be regarded as being much better than any other. The circumstances of the case should be the main guide as to which method is adopted, but usually it is important to see that consistency in the method adopted is retained in relation to successive stocktaking periods.

PART 2.

STANDARD COST ACCOUNTING.

CHAPTER 17.

THE DEVELOPMENT AND PRINCIPLES OF STANDARD COSTS.

Cost Accounting is of comparatively recent development, though there are many cases where cost accounting methods similar to the job order system of to-day were in operation during the latter half of the last century. The main impetus to its growth came from the first world war when payment for war contracts was frequently tied to cost. The inauguration of the Cost Plus Contract came during this period and frequent surveys were made, particularly in England, to ascertain to what extent cost accounting methods were in use. It was found that the use of cost accounting and business efficiency frequently went hand in hand and organisations were encouraged to inaugurate costing procedures.

Birth of Standard Costs.

Both during and immediately after the first world war, there was a rapid extension of costing methods, and this went on until 1921 when the period of deflation became evident. This was the signal for the raising of the first queries as to whether cost accounting methods were the best obtainable. Indeed, the whole subject of cost accounting then came under critical survey. It was only natural that in a search for ways of escape from the conditions engendered through the deflationary period, there should be an examination (amongst other things) of the weaknesses in cost accounting functions and control. As a result a growing body of opinion considered that criticism could justifiably be levelled against existing cost accounting methods because of the following factors:—

1. There was an unrealistic approach to the question of cost finding, and this was best illustrated by the fact that the costs of idle equipment (very often the result of over-equipped plant) were included in product costs supplied to management. This meant, of course, that costs of products were inflated to include expense resulting from over-equipment, even though the products in question had nothing to do with the over-equipment. Management found that cost accounting figures gave no true guide to the position and were not helpful as managerial guides in the control of manufacturing and selling policy. This was contributed to by the fact that costs of products naturally varied according to the amount of production capacity used. These factors were frequently so important that they obscured other matters which should have been the focus of managerial attention.
2. The portrayal of cost figures could not be made in such a way as to give a real index to efficiency obtained. Costs could be compared with those of the preceding period, but, here again, so many other factors intruded that the picture was usually distorted. This distortion was particularly annoying at a time when management's biggest concern was the current operating conditions which were such as to necessitate every drive towards efficiency.

3. The preparation of the cost figures was frequently so delayed that when they became available they were of little use. They were historical costs, and as such were interesting from a history angle, but were too late to be used for efficiency purposes.
4. Many of the systems were most expensive to operate, and, particularly because of the weaknesses described above, management commenced to ask whether the value obtained from such cost accounting systems was really worth the cost. Where large sums were incurred to obtain figures which became available so late that the time for their useful interpretation had gone, it was only natural that the expense of such systems should come under critical survey.

This criticism came from all sections of management. It was not confined to the top-line executive. It came from the Sales Manager, who was in trouble with selling prices and policy. It came from the Production Chiefs, who compared the methods of cost accounting detrimentally with the engineering approach. Particularly from the engineer came the request for something which he could really use, and which could be treated by him as a guide and a chart to help him while the job was actually in process. It came also from the cost accountant, who was himself dissatisfied with the results being achieved. and felt that it should be possible in some way to eliminate the weaknesses of existing systems and to provide something which would assist in a real control at the time such control was needed.

These factors became increasingly important and the demand for revision became increasingly insistent when conditions became so difficult that industry in general was faced with serious losses. The weaknesses of cost accounting were not important when profits were comparatively easy to obtain, but the swing of the pendulum brought the whole subject into relief. Some concerns, noting the expense involved in recording, accumulating and sorting time tickets and requisitions and the amount of clerical work involved, decided to dispense with cost accounting. Many others, however, felt that it must be possible to improve the methods in use by tying cost to some kind of target, and during this period the idea of Standard Costs was born. It took the depression to bring a wider realisation of the advantages of Standard Costs, and to secure a universal acknowledgment of the part that Standard Cost Accounting could play in managerial efficiency.

The solution was then attempted along the lines of a progressive revelation of costs and such comparisons as were necessary to reveal inefficiencies and discrepancies. This, obviously, implied the use of some kind of standard or aim, so that actual results, when compared, could throw into relief differences demanding the attention of management. The idea of some kind of standard was not new in itself. Many years before specificational estimated costs had been used, but only in primitive fashion, and they had in turn given place to the job order system. With the turn of the cycle, the Standard Cost came, if not to supplant, at least to share the field with other types of cost.

Definition of Standard Costs.

Standard Costs are predetermined costs, that is, they are costs calculated before production to cover the product to be manufactured. This obviously includes an estimate of the materials to be used, and the price to be paid for such, a calculation of the amount, classes and costs of labour necessary together with that proportion of factory or manufacturing expense applicable to the product to be manufactured. These various factors are calculated after a thorough survey of all conditions affecting the manufacture and usually it is necessary to lay down certain conditions upon which the figures can be calculated.

Standard costs are obtained from the operation of a Standard Cost System—that type of cost accounting system where pre-determined standards are compiled in relation to each element of expense and are subsequently compared with actual costs, the differences or variances being used to measure and control the efficiency of the manufacturing operations.

The Standard Cost system is therefore designed to determine:—

(a) Standard Costs,

(b) Actual Costs,

(c) Variance of actual costs from standard costs,

(d) Analysis of and responsibility for those variances.

The variances form one of the most valuable features of Standard Costs, as these represent the differences as against the standards, and it is upon these differences that management's attention will most frequently be focussed.

The Standard Cost of a product may therefore be defined as the sum which is obtained by pricing a manufacturing specification of the product at predetermined rates for the materials, the labour and the expense entering into its manufacture.

Advantages of Standard Costs.

As Standard Costs were at first inaugurated to overcome the weaknesses of historical costs, it can be understood that the advantages of Standard Costs largely arise out of the elimination of those cost weaknesses. The principal advantages can therefore be stated as follows:—

1. The historical aspect is eliminated, by reason of the use of predetermined figures. These, compiled before production is commenced, are readily available, and in the first place are in themselves a valuable guide to management. There is a secondary function in their use for comparison.
2 The comparison between standards and actuals discloses the variation, and at once management can take advantage of the principle of exceptions, and concentrate its attention upon those factors which have not proceeded according to plan. The fundamental principle behind Standard Costs is that management is not concerned with the things which go right, but should concentrate upon those things which do not do so.
3. Price and production policies may be formulated in advance. If the standards are carefully compiled they can be used in connection with the preparation of such policies. There is much to be said for the contention that Standard Costs are the best bases for establishing such policies. Such standards usually eliminate the effects of fluctuating volume, and, furthermore, avoid any cost increases due to waste and inefficiency. Indeed, the mere act of setting standards, if carefully done, shows up avoidable waste and inefficiency, before the production is commenced.
4. Standard Costs lend themselves to the provision of incentives for workmen and supervisors. The standard labour cost of a product is

very often based upon figures taken out in connection with incentive schemes. Alternatively, the labour standards may themselves be the bases adopted for incentives. Similarly, standards relating to materials to be used may also be the basis for some kind of incentives. Again, quality control can often be made possible through Standard Costs, and may also figure in connection with an incentive plan.

5. Standard Costs are usually less expensive to operate. There is frequently a large amount of work in the preparation of the standards, but, once these have been calculated, the Standard Cost system is designed towards the calculation of the variances, and furthermore the preparation of managerial statements based on Standard Costs, becomes relatively simple.
6. Standard Costs provide a common denominator, and apart from the variances, give a ready basis of comparison between one period and another. Indeed this is the fundamental aspect of one particular type of Standard Cost system, which uses as its basis an index figure with which all other figures are compared.
7. Standard Costs are of great value as a basis of stock valuation. The use of the standards facilitates the completion of stock figures, both in relation to the calculation of amounts applicable to products and in arriving at final stock figures.

In addition to the foregoing specific advantages, there are some general advantageous aspects, which may be more evident in some industries than others.

Application of Standard Costs.

Whilst the growth of Standard Cost systems has been remarkable, it cannot be said, at this stage at all events, that they are universally applicable. It is true that some of its keenest advocates maintain that a Standard Cost system can be used in any type of business. It must be remembered, however, that there are some types of business where it is almost impossible to predetermine costs, and many others where the work involved in such pré-determination would be greater than the advantages which would accrue. In some jobbing shops estimates may be prepared, but to convert these into acceptable standards and to trace such standards through the accounts in such a way as to promote the variations may be more troublesome and give little in the way of advantage over the job order system, particularly where the latter can operate with speed and efficiency and make known the actual costs very quickly after a job has been completed. Nevertheless, the field of industry which can be catered for by Standard Costs is large, and has been shown to be an expanding one. It is, however, a matter for each individual business to decide whether a Standard Cost system will meet the needs of the particular organisation.

Cost Standards.

Many of the advantages described above can be obtained by the use of cost standards. By these are meant carefully prepared estimates which are used for the purpose of comparison with actual costs when the latter become available. Cost standards do not figure in the cost accounting entries—only the actual costs do that. They can, however, be used for portraying efficiency and for keeping a current check upon the actual costs as they mount. In the case of Standard Costs, however, the figures involved are part of the cost accounting system, and are used in connection with the balancing procedures. They form one set of figures, and the difference between these and the actual costs, in the form of variations, makes another set of figures. The use of Standard Costs, however, gives a much more complete picture and it will frequently be found that their incorporation in the cost accounting system does not involve much more work than the use of cost standards. Probably the best example of this is to be found in the use of predetermined expense rates, even with job order costs. It will be remembered that instead of individual applicable rates for expense being worked out each month, or for some other period, the predetermined expense rate is calculated and applied and only the difference is taken up at the end of say, every 6 or 12 months. Whilst, therefore, the cost standard does give some advantages, the use of standard costs may not only yield better results, but may in certain cases actually be cheaper.

Types of Standards.

Before any consideration can be given to the operation of Standard Costs, there must be a clear conception of what is meant by the term "Standard." Obviously it is some kind of measure, but the measure may be calculated in different ways. In the first place it may be of an ideal type—something to aim at. It may represent an end to be achieved—the end representing something which, if achieved, should reflect considerable credit on the organisation.

On the other hand, the standard may represent that most likely to be attained. This may not in itself reflect credit on the organisation, nor, unlike the ideal, may it involve a concerted effort. It may simply be a figure arrived at after a full analysis and examination of conditions as they are likely to exist.

There is a third type of standard—a basic standard. This is best illustrated by comparing it to the index figure in, for example, the cost of living adjustment. It may not be an ideal figure, nor need it be an attainable figure. Rather is it a basis, which is used as a measuring rod with which all actual figures can be compared.

There are fundamental differences between these types of standards, though the ideal and the attainable have many factors in common. Furthermore, there are differences between the cost accounting systems necessary to record these types of standards. Here again the fundamental difference lies between the ideal and the attainable on the one hand, and the basic on the other.

Briefly therefore, standards used in Standard Cost systems can be based upon:—

1. Ideal conditions.	Ideal and attainable Standards.
2. Reasonably attainable conditions.	
3. Probable actual conditions.	
4. Average actual conditions over a period	
5. Budgeted costs.	
6. Normal conditions.	
7. Replacement conditions.	
8. Capacity to produce.	
9. Capacity to sell.	
10. Basic conditions.	Basic Standards.

Types of Standard Cost Systems.

The different types of standards necessitate the employment of different methods of Standard Cost systems. These can be considered under the two broad headings of:—

1. Current—representing the ideal and attainable types of standards.
2. Basic—covering the basic or index standard.

1. *Current Standard Costs.*

This type of Standard Cost system uses as its standards some kind of expected actual, attainable or desirable goal, such as those listed above. Obviously the setting of standards of this type involves a complete investigation into all the products of the business and the calculation of costs in terms of each cost element. The exact procedure will, of course, depend upon the type of standard involved, but in the case of expected actual, a thorough survey of past figures and present and future conditions will be necessary. This data then has to be interpreted and converted into the expected results for the ensuing period. With the attainable there is something more in the way of a task involved, though the figures are still kept within realisable margins. In the case of the desirable there is much more of the task feature involved, and the cost standards represent something to be aimed at, which, having been accomplished can be regarded with much satisfaction.

The actual treatment in relation to cost accounting records is the same for each of these three factors, and the records can be set up in any of the following ways:—

1. The Work in Process Control A/c can be charged with the actual cost of materials and labour, and a normal expense rate, and credited with the standard cost of production of finished goods and work in process. This is the principle involved in Estimate Costs, which are described in Chapter 19.
2. The Work in Process Control A/c is charged with the standard cost of operations completed and is credited with the standard cost of finished goods. In this case, the work in process is carried forward in the books of account standard values. This method is described in Chapters 20 and 21, and is referred to throughout as the Ideal Type of Standard Cost.

It will be obvious that where the standard represents expected actual, attainable or desirable figures, a most important factor involved is the necessity for changing the standards. It is in this factor that the basic method of Standard Costs obtains a most important advantage. There may be a great deal of work involved in the preparation of standards and on this count alone, changes should be avoided as much as possible. In addition, however, the changing of standards reduces the comparative value of Standard Costs, particularly between one period and another, and, furthermore, psychologically reduces the importance attaching to variances disclosed within the standard cost system. In the case of actual performance, the condition might vary almost from month to month, and under those circumstances the changing of standards may not only be undesirable, but almost impossible. This also applies, possibly to a somewhat lesser degree, to the attainable or desirable standards. In the case of the latter, however, there is a basis for permanency at least for a financial period. In this case the standards are based upon figures representing a desirable objective and the fact that the objective is not reached is not a good reason for changing the figures. Nevertheless, if the desirable objective is to be treated as a target, it is important to see that such target is not either out of reach or attainable without effort. To that extent, there is also a case for a change of standards at least periodically. The disadvantages of changing standards has already been referred to briefly and these are of sufficient importance to over-ride other considerations and to ensure avoidance of changes as long as possible.

2. *Basic Standard Costs.*

The basic system of Standard Costs overcomes the serious objection lodged against the other method. There is no need to change the standards, except under very unusual conditions. Indeed the value of the system rests primarily in the permanence of the cost standards once adopted. These standards are used as index figures in the same way as a cost of living index. In the latter, a basic figure of 100 for 1914, might show 146 for 1938, 148 for 1939, 154 for 1940, 164 for 1941. Similarly, a basic figure to cover raw materials costs in a product may be £10/10/- in 1938, £10/11/- in 1939, £11/2/- in 1940, and £12/10/- in 1941. There is a basis of comparison throughout, even though the 1938 figure is widely different from the 1941 amount. Whilst these factors operate in relation to prices, conditions usually attaching to Standard Costs in relation to quantity and quality are still in operation, and frequently quality control of an ideal nature may be used in connection with a basic standard cost system.

An unusual feature of this type of system is the use of two debit and two credit columns, one of each being used for the Standard Costs, and the others for the Actual Costs. The relationship between these two is usually arrived at by ratios, and the two sets of figures are carried throughout the accounts. Thus, unlike the methods under the Ideal or Current System, in the case of a Basic Standard Cost the Work in Process A/c is charged with both actual and standard costs, and is cleared by actual and standard costs of finished goods. Work in process inventory is carried through at actual cost and not at standard cost.

A simple example of the difference between ideal and basic methods can be given in relation to material which in 1938 cost 20/- per unit, and in 1942 cost 25/- per unit. If the standard cost system was first operated in 1938, it is probable that the standard cost of the material under the two methods would be the same—viz., 20/-. In 1942, however, the standard cost under the ideal method may be 25/-, and under the basic method would still be 20/-. If the actual cost in 1942 worked out at 27/6, the material cost variance due to price under the ideal system would be 2/6 or 10%. Under the basic method, the standard cost for 1942 still being 20/-, the variance would be 7/6 and the ratio would therefore be expressed as 137½. The ledger accounts would, however, show both the standard cost of 20/- and the actual cost of 27/6.

It will be noted that under the first method there would be an automatic cause for inquiry as to why the price exceeded the standard cost. In the case of the second method, the inquiry is in relation to the progressive increase from the 1938 period, and the higher figure for 1942 as against 1941.

No matter what type of Standard Cost is adopted, one of the most important features—one which can cause success or failure within the system—is the setting of the various standards in relation to each manufactured product. The methods by which standards are set are examined in the next Chapter.

CHAPTER 18.

SETTING STANDARDS—MATERIAL, LABOUR AND EXPENSE.

The setting of standards must be carefully carried out, as the success of the standard cost system, particularly of the ideal type, may depend upon the degree of accuracy attained. Where Standard Costs are to be used to guide managerial policy, it should be obvious that errors and incorrect conclusions may have dire results. The setting of standards is seldom easy and careful attention paid to this aspect of the work will invariably result in good dividends.

The setting of standards involves:—

1. A complete breakdown of all materials in every product to be manufactured during the coming period.
2. A determination as to how much of such material and what type, quality and texture of material is required.
3. An analysis of the cost of such material and the placing of a standard cost for each type of material.
4. From such information the calculation of the total material cost for each product to be manufactured.
5. An analysis of all labour operations necessary in connection with every product
6. An examination to show what types and grades of labour, and if need be, what types and kinds of machines will be involved.
7. The pricing of the various types of labour required.
8. From such particulars the preparation of a standard cost of the labour required in connection with every product to be manufactured.
9. A determination of the amount of factory expense likely to be incurred during the ensuing period.
10. An apportionment of such expense according to usual pre-determined bases amongst each product to be manufactured.
11. The combination of the material, labour and expense factors to give the total standard cost of each product to be made.

The method would be similar no matter whether the type of standard was expected actual, attainable or desirable, and the initial procedure in the case of basic standards may also be the same.

It can be assumed that a great number of factors would have to be closely examined before the information outlined above would become available. Indeed the setting of standard costs involves a most thorough investigation of practically every phase of the business. Not only is the preparation of standards involved, but the clearance of work in process accounts necessitates a control over production procedures. It is safe to say, therefore, that before standards can be correctly set, not only must the specifications of all products be examined and analysed, but the productive methods in operation, the types of machines in use, the features of production control, the methods of recording movements of production within the plant, and the functions and responsibility of all personnel must be known.

Before proceeding with the installation of any standard cost system, there are several other factors which must be examined. In the first place, the type of classification of accounts in existence must be noted. The classification suitable for a Job Order system will not be that required for Standard Costs. The classification must give effect to the accounts which will set forth both the standards and the variances. A classification suitable for a standard cost system in a textile mill is shown in detail in Chapter No. 28.

The functions of the personnel must be noted. Particularly in the analysis of variations, there will come opportunities for a functional division of responsibility. By this method the adverse conditions responsible for variations may most easily be changed.

If there is a bonus system in operation, its basis and its method are of the utmost importance. The adoption of labour standards should only be attempted after such analysis has been made, and it may then be possible to use the bases or standards adopted in connection with a bonus system for calculation of labour times and rates attaching to the products manufactured. Furthermore, the bonus system will also affect the indirect labour and, therefore, certain accounts which find their way into manufacturing expense.

It can be repeated, therefore, that the inauguration of a standard cost system necessitates a close examination of almost every function of the business, and this examination in itself often results in advantages and yields information of the greatest value to management.

1. Setting Materials Standards.

The total cost of all products manufactured within a business is made up of the individual costs of each product. In turn the cost of each individual product is made up of:—

(a) the cost of the materials,
(b) the cost of the labour,
(c) the proportion of factory expense applicable.

The cost of material entering into a product involves two main factors, viz., the amount of material and the price thereof, and it is these two factors upon which concentration must be made in arriving at a standard material cost.

(a) *Material Quantities.*

The first step to be taken in order to obtain the standard material cost of a product is to arrive at a list of the types and quantities of materials involved. The exact form of such list obviously depends upon the type of goods being manufactured. In the case of an ice cream manufacturer, for example, there may be a formula, such as that set out hereunder:—

Pounds Ingredients	Pounds Fat	Pounds S.S.	Pounds T.S.
4.50 Sugar			4.50
.12 Gelatine			.11
.03 Improver			.02
8.28 Cream 40 per cent....	3.31	.44	3.75
10.75 Milk 3.5 per cent.	.37	.92	1.29
3.00 Evaporated Milk 8-18	.64	1.44	2.08
.62 Egg Yolks			.31
1.00 Water...			
33.30	4.32	2.80	12.06

Composition—12.197 per cent Fat ; 8.40 per cent serum solids ; 36.21 per cent total Solids ; 13.51 per cent Sugar ; .36 per cent Gelatine.

In the instance of a general engineering shop, it would be necessary to prepare a bill of materials. The procedure to be adopted in such a case could be:—

1. The drawings of the job to be carried out are received.
2. Each drawing is examined by the appropriate engineer who sets down the type of material required and the quantity to be allowed.
3. A decision is made regarding the grades of materials involved.

The question of the amount of material to be allowed, may not, however, be as easy to arrive at as at first appears. It may be a comparatively simple matter to arrive at the actual amount of material which will form part of the finished product. The finished size of the material would be available from the drawing. How much material should be allowed at the outset is another matter. This involves the important question of what would be a standard allowance for waste. Here the exact type of standard which has been adopted would be of importance. If, for example, the standard was to be a target to be aimed at, the allowance for waste may be of such a quantity as would result in an acceptable performance if the waste was kept down to the allowance made. On the other hand, the waste allowance may be figured in terms of a reasonably good operator, because it may be felt that if such waste allowance is higher, it should be a subject for investigation. A further alternative presents itself, as the allowed figure may be based upon what could normally be expected from the existing staff. In such a case the waste allowance may be considerably higher than that which would operate for a good employee.

Of all these methods, probably the best is that which provides some kind of task or objective. It must be remembered that one of the greatest values which flows from Standard Costs is to be found in the analysis of the variation accounts. If, therefore, the standard waste allowance is allowed to reach such a figure as to prevent inefficiency finding its way through to the variance accounts, one of the greatest achievements of Standard Costs is lost. It seems therefore that once the finished material is ascertained, the allowance for waste should include, firstly, the unavoidable waste, and, secondly, an amount for avoidable waste, which would represent a very acceptable figure to management. Once the basis to be adopted in connection with waste is formulated, the quantities of materials can be completed and the bill of materials finalised.

In the case of a textile mill, the steps to arrive at a standard material cost may be as under :—

1. It is desired to arrive at the standard material cost of 100 dozen nightgowns, of style A246.
2. An examination of style A246 is made and the relevant features noted.
3. A decision is made as to the type of cloth that will be needed.
4. The specifications of the nightgown are examined and the quantity of fabric involved is calculated.
5. A decision is made as to the quantity of fabric in the finished product.
6. The actual material in the completed garment being known, the most economical cloth from which this can be cut is decided upon. This will involve decisions as to the width of the cloth.

7. Obviously the fabric required for the finished product cannot be cut without some extra allowance being made for waste, etc. This is calculated and the final quantity of fabric required from the knitters is determined.
8. A calculation must be made as to the amount and type of yarn necessary to knit the required amount of fabric. It may be, of course, that this fabric is used for a number of garments and not specially knitted for this particular requirement.

By the foregoing methods it becomes possible to arrive at the quantity of fabric which should be allowed for to cover this requirement. Here again the waste allowance is probably the most difficult to determine. Certain allowances would be inevitable, no matter what employees or methods were in operation. Over and above these allowances, however, there would be others which would be dependent upon the skill of the operator and possibly the type of fabric. These are the ones which are difficult to judge and probably the best method is to arrive at a figure which would represent a desirable amount. This would result in a procedure whereby any excess in material quantity over and above the final figure thus allowed would find its way into the material quantity variation account and would be the subject of investigation accordingly.

Once the fabric quantity has been obtained, the other materials necessary for making the order would be listed, and, when completed, a total materials specification for the 100 dozen nightgowns would be available.

In the case of a furniture manufacturer, the procedure would be similar to those outlined above. Here, the question of waste allowance may be a most important one, and may call for very keen judgment. Waste may, in such a case, take different forms, as for example :—

1. Waste which is inseparable from treatment of the product. Where a board has to be sawn, there is the width of the saw cut which is turned into sawdust. Similarly, a board which has to be planed requires an allowance over the finished size to cover the material removed by the planing operation.
2. Excess waste which is occasioned by some degree of inefficiency. The allowance made for planing may, for example, be much more than should be economically allowed.
3. Because of blemishes in the timber, a portion of a board might have to be discarded, and this may operate irrespective of the efficiency of the employee.
4. The required part may be taken from an uneconomical piece of timber. In such a case a piece required in a finished size of 12 inches may be taken from another piece of 20 inches, without any attempt being made to cut it from a piece where the waste allowance would be much less.

In the case of the furniture manufacturer, once the waste allowance is determined, the various materials including qualities and grades, necessary to produce the furniture items, are specified in a bill of materials which would include not only solid timber, but plywood, glue, nails, screws, hinges, handles, putty, paint, etc.

It may frequently be found that the waste coming from one product may be of use for something else. Thus, in the case of the order for nightgowns, it may be found necessary to cut the requirements from cloth which even when of the most economical size, will yield some pieces which may be of use for something else. The shape of the garment may in itself be responsible for these pieces. In certain cases they may be of use in the manufacture of smaller garments. The problem therefore arises as to how these should be treated. It is necessary to analyse the uses to which materials which become available in this way may be put. In the case of pieces coming from the cutting of the nightgowns, the following may operate:—

1. A certain proportion may be of use in the cutting of smaller garments.
2. Some may be useful for trimming purposes in connection with other garments, without knowing just which garments they will be used on.
3. Some may be of no further use in the factory, but may have a saleable value outside.
4. The remainder may have no value, either within or without the factory.

A number of problems arise as to the standard cost treatment of the remnants of fabric left after the cutting of the nightgowns. These can be described as follows:—

1. The standard material quantity for the nightgowns may be taken as including all remnants. In such a case, the total quantity would be used to calculate the standard material cost, and the variations would represent the actual amount used, which may be more or less than the standard quantity. In this case the question of treatment of the remnants arises. If, for example, other garments have been cut out of the remnants, they would appear as having no material cost. This would obviously be wrong and would be charging to one product what could safely be charged to another.
2. The material quantity for the nightgowns might be set down as being the total finished quantity in the nightgowns, plus that portion of fabric which cannot be used for the manufacture of the smaller garments. In such a case the standard quantity of the nightgowns would represent the finished material in such, together with the pieces left over after the smaller garment has been cut out. In other words, it would be the total material used less the net amount required for the smaller garments. This has the advantage of taking away from the nightgowns the minimum material properly chargeable to the smaller garments, and consequently the material quantity chargeable to the smaller garment can be converted into a Standard Cost of such.
3. There is still, however, the problem of the waste which may have a potential use for trimmings and that which has no use within the plant, but is saleable outside. In the case of trimmings, there are two methods which can be adopted :—
    - (a) The cost of fabric involved may be disregarded in compiling the standard materials for the nightgowns. In this case, it would be necessary to charge the quantities transferred to trimmings to a Trimming A/c, credits to such account emanating either from Standard Charges for Trimmings or from something in the nature of a general charge.
    - (b) The cost of the fabric involved in trimmings and saleable or unsaleable pieces may all be charged to the cost of the nightgowns. In such a case there would be no allowance for trimmings in connection with such garments used as such. In the case of saleable pieces, receipts for such sales would have to be ac-

counted for and probably would be best treated by including them under an account such as "Other Income."

4. The residue after the cutting of the nightgowns could be treated in the following manner :
   (a) Those pieces out of which other garments could be cut would be used for this purpose and charged to the other garments.
   (b) Trimmings would be charged direct to a trimmings account, and cleared as provided in 3. above.
   (c) Saleable pieces would be segregated and would not be charged into the fabric for the nightgowns, but instead to a saleable scrap account. The value at which these would be charged would be that estimated as likely to be received. When the fabric was actually sold the credits would go to this account and the debit or credit balance would represent the margin of error between the estimated and actual receipts.
   (d) The unsaleable scrap would be purely a charge against the nightgowns.

It will be seen from the foregoing that there are many factors to be taken into account and many different treatments possible. Which is the best method depends upon the individual circumstances operating and is a matter for study beforehand, so that that method which gives the fairest results will be decided upon. It is quite possible that in the case given as an example, the whole of the fabric involved in the cutting for nightgowns would be charged to the nightgowns, except for that which could be used for smaller garments.

The question of packing materials is also of importance. The final product may not be completed until packed, and this may in itself raise many problems. If the boxes necessary were purchased from outside, it is a comparatively simple matter to arrange for the cost of the box to be included. If on the other hand, the boxes are manufactured within the plant, then a separate Standard Cost would be taken out for the boxes. They may be boxes of a standard line, or they may have to be manufactured specially. The procedure would be exactly the same, inasmuch as it would be necessary to take the specification of the box, to decide upon the materials involved, to determine the manufacturing operations and from all these things, arrive at a standard list of material quantities involved.

(b) *Material Prices.*

The ascertainment of material quantities is the first step in arriving at a material Standard Cost, but it is still necessary to decide upon the prices which are to operate in relation to each material appearing in the specification.

The pricing of the materials also bears a relationship to the guiding principle behind the type of standard cost involved. If, for example, it is to be treated as a desirable figure—a cost to be aimed at as a target—the task of pricing the materials must bear this factor in mind. It must take into account all possible economies which could be obtained by a most efficient purchasing outlook, and full cognisance would have to be taken of advantages to be gained from quantity buying and quantity discounts, and from such factors as indenting and purchasing direct from the manufacturer. These factors should also be taken into account if it is meant to be an attainable cost, but possibly not to the same degree—the task may not be set so highly.

In the case of expected actual, the efficiency factor may be judged in relation to what has been the position in the past. Even in this case, however, it must be remembered that as the variation accounts show departures from the bases set down, it would be foolish to allow inefficiency to be totally taken into account in setting the standards, because the variations would then not show up such inefficiency.

In each of the above cases, before the pricing of materials is carried out, it is essential that a very close examination be made of the past, existing and probable future prices. Only in this way can trends be gauged, and can an effort be made to ascertain any factors which will be of importance in the control of material prices in the future. Where shipments of materials have to come from overseas, the position may be simplified by the fact that contracts may already have been let to cover materials which will be used during the ensuing period. In ordinary times, the task of pricing the materials while requiring careful consideration can usually be accomplished with reasonable accuracy. In times of war the position may be even easier or much more difficult. Where legislation covers the prices of materials which are to be used, and it is known that these are virtually fixed prices, accuracy is simple. Where, however, no legislative action covers prices, and these are dependent upon overseas conditions, the problem can be difficult. These latter conditions may even have the effect of making it necessary to give consideration to the possibility of using substitutes.

Where stock control methods are in operation, and a first-in first-out method of charging has been adopted, the expected actual can often be attained with absolute accuracy, because it may be found that there are sufficient stocks in hand, and at prices known, to cover the requirements during the ensuing period.

The finalisation of material prices may be rendered somewhat more difficult where process parts must be purchased. These may be obtained in such circumstances that fluctuations in costs might be hard to gauge. Prices must, however, be finalised before the total material standard costs can be totally determined.

When the quantities of all materials, together with grades and all other relevant factors are known, and the prices relating to each have been ascertained, it is only a matter of arithmetical calculation to arrive at the total materials standard cost.

2. Setting Labour Standards.

It was mentioned in connection with the setting of materials standards that it may be necessary even on that account to analyse thoroughly the labour operations involved in the manufacture of a product. Even if this is not necessary for materials, it is most certainly so in the case of labour. A standard cost of labour is made up of three main factors:—

(a) The amount of time which it is necessary to spend.

(b) The grade of labour involved.

(c) The rate applicable thereto.

(a) *Labour Times.*

The methods to be adopted to set labour standards whilst conforming to the same general rules, may vary somewhat in different industries as for example:—

(a) In the case of a confectionery plant, the complete schedule of operations involved, and the number of employees involved in connection with each operation would be recorded.

(b) In the case of an engineering shop, the drawing would be very closely examined and the work would be planned from the time the materials became available until the finished product was obtained. This may involve routing the work through several departments, and it would probably be necessary to analyse the machine operations involved. Careful attention would be necessary in connection with these aspects, because later the times allowed would have to be interpreted in relation to grades of labour, and the rates applicable to the grades. Each machine operation must be studied in detail, particularly where it is necessary to set bonus times to cover such operations. (See Figure No. 75.)
With a textile mill, the operations would be listed as they affect such departments as knitting, cutting, machining and finishing, and the times necessary in connection with all operations would be calculated.

FIGURE No. 75.

OPERATIONS TO MACHINE A FORGED STEEL PACKING PIECE.

TOOLS REQUIRED.

Milling Side A.	*Milling Side B.*	*Milling Side C.*
Horizontal miller	Fixture	Fixture
Fixture	Two ⅞″ × 3″ concave cutters	2½″ × 1¾″ Plain milling cutter
Two ¾″ × 3″ convex cutters	Spacing collars	1″ Arbor
Spacing collars	1″ Arbor	Spacing collars.
1″ Arbor	1″ Micrometer .375″ × 1½″ Drill rod.	

Milling Side A.

Operation 1.

Mount the fixture on the table.

Operation 2.

Mount the cutters on the arbor.

(1) Measure the distance between the two adjacent sides of the setting grooves in the fixture. These grooves are generally spaced so that the standard length of the spacing collars can be used.

(2) Mount the cutters on the arbor with the required number of spacing collars between to bring the cutters to the required distance apart.

(3) Place the bearing collar on the arbor so that the overhead bracket will come as close as possible to the cutters and yet not interfere with the work.

(4) Clamp the cutters on the arbor, mount the bearing bracket and clamp securely in place. It is generally necessary to use the end braces on a job of this kind unless the work is small or of such a shape as to require small cutters.

Operation 3.

Set the fixture to the cutters.

(1) After the cutters have been mounted on the arbor in the desired position, move the table over until the setting grooves come directly under the cutters.

(2) Turn the spindle by hand until the face of a tooth on the bottom of each cutter comes directly vertical.

(3) Set the table so that the setting grooves in the fixture match the faces of the cutters and that the cutting edge of the teeth barely touch the bottom of each groove.

(4) Clamp the saddle in place on the knee and clamp the knee to the column.

Operation 4.

Place the pieces in the fixture.

(1) Move the table over to the starting or loading position.
(2) Be sure the fixture is cleaned on the inside.
(3) Be sure the pieces rest firmly on the supports in the fixture and if necessary file off any burrs or lumps that may interfere.
(4) Screw the clamps up tight and drive each piece solidly down on its support. The operator, with a little practice, is able to know when the pieces are solid by the "feel" of the hammer when tapping them down. It is not necessary to drive them hard but merely tap them lightly until they feel solid. Striking them a hard blow will cause them to bounce off the supports.

Operation 5.

Mill the pieces.

(1) Set the feed for about .005″ per tooth in the cutter.
(2) The cutting speed should not exceed 50 feet per minute.
(3) Use a heavy stream of cutting compound on the cutters.
(4) Start the machine and take the cut across the piece. Be sure all scale is removed on the first cut. If the pieces do not clean up, they must be scrapped because they will be undersize.

Operation 6.

Mill the second pair of pieces.

(1) As soon as the cut is completed on the two pieces, stop the machine and bring the table back to the starting point.
(2) Remove the two pieces from the fixture, clean the fixture out thoroughly and mount two more pieces in place.
(3) Machine as before.
(4) Repeat these operations until all the pieces on the job have been milled on the one side.

Milling Side B.

Operation 1.

Tear down the set up for the previous operation.

Operation 2.

Mount the fixture for milling side B on the table and mount the two concave cutters.

Operation 3.

Set the fixture to the cutters.

Operation 4.

Mount the two pieces in the fixture.

Operation 5.

Take a trial cut on the two pieces, stopping the machine as soon as the cut has proceeded far enough to allow taking a measurement. A surface about ½″ long will be sufficient.

Operation 6.

Remove each of the pieces from the fixture and measure them.

Operation 7.

After the table has been set to the required height, take the cut all the way across the 2 pieces.

Operation 8.

Stop the machine, bring the table back to the starting point, remove the 2 pieces and measure each one to be sure the setting is correct.

Operation 9.

If the setting is correct, the second pair of pieces should be machined and measured as before.

Milling Side C.

Operation 1.

Tear down the set-up used for the previous operation and mount the fixture for milling side C in place on the table.

Operation 2.

Mount the cutter on the arbor and set the fixture to the cutters. Be sure both the pieces and the guides upon which they rest are clean before the pieces are mounted in place.

Operation 3.

Mount the two pieces in the fixture and mill the one side.

Operation 4.

Have the first two pieces measured before machining the second pair.

Operation 5.

If the two pieces just milled have been found to be correct, continue the operations until all the pieces on the job have been milled.

Milling Side D.

Operation 1.

Remove the fixture used on the previous operation and mount the other fixture in its place.

Operation 2.

Set the fixture to the cutter.

Operation 3.

Clamp two pieces in the fixture and take a trial cut about ½″ long.

Operation 4.

Measure the two pieces with a micrometer to be sure the setting of the machine is correct.

Operation 5.

After the setting is found to be correct, complete the cut, remove the two pieces from the fixture and measure each one.

Operation 6.

Repeat these operations for all the pieces on the job, measuring every fifth pair of pieces.

Where no bonus system is in operation, the work would have to be carefully carried out in relation to all products for which Standard Costs were desired. If there is a complete standard cost system to be installed, this would mean all products. Many organisations desiring to adopt Standard Costs, however, would already have made some arrangements for the inauguration of bonus schemes. The essential basis behind any bonus scheme is to arrive at a task time. In some organisations only portion of the works are on bonuses. Usually, however, the bonus bases can be adopted as being suitable for the calculation of the standard cost. Indeed, bonus systems have reached such a high standard in certain industries, that the degree of accuracy possible in setting standard labour costs is much higher than that possible in connection with Standard Costs for either material or expense.

Usually the bonus system lays down a standard time for each operation carried out within the plant. An example of standard times allowable in connection with the manufacture of cardboard boxes is shown hereunder in Figure No. 76.

FIGURE No. 76.

STANDARD OPERATIONAL TIME ALLOWANCE.

There are three pieces to be assembled in making these containers :—

(a) The body piece which comes flat and has to be pushed into shape.

(b) The bottom, which is a round card-board piece fitted into a tin rim.

(c) The inner bottom piece, which is a round of card-board.

The elements of this work are :—

1. Pick up body piece and bend in the serrated flaps—place piece on pile ready for assembly.
2. Place bottom piece in fixture.
3. Clip fixture to lock.
4. Pick up side piece, position in bottom piece and push into shape.
5. Place inner bottom piece in position.
6. Release clip, remove carton from fixture and place on floor.

STANDARD TIMES ALLOWED.

	Standard Time for 100 boxes. *Minutes*	*Seconds.*
Operation 1.	12	40
2.	2	20
3.	1	50
4.	14	10
5.	4	30
6.	12	10
...	47	40

(b) *Grades and Rates of Labour.*

When the standard times and grades of labour necessary have been estimated, there is a further problem in the rates to be allowed. This may not be as simple as may appear at first, because the rates adopted may be those which look as though they will be operating during the ensuing period. This would involve an analysis of future conditions, including a calculation as to the future trend of wage rates. The variations in the basic wage may have a very important effect upon the amount to be allowed in building up the standards. Where a bonus system is in operation, not only can times likely to be taken be obtained but also information of the greatest value in the finalisation of estimated wage rates can usually be gained. Time study men are usually best equipped to prepare the Standard Labour Cost of products to be made.

Where the products have not been made previously, but a bonus scheme is in operation, the first task is one of arriving at all the operations involved in making the product. The bonus scheme will probably already have provided operating costs covering every operation within the plant, and consequently calculation of the Standard Labour Cost is simplified. Where no bonus scheme is in operation—where no time study men are employed—the problem of arriving at a Standard Labour Cost is much more difficult. Frequently, an attempt is made to arrive at the time involved by a comparison with similar work which has been produced previously. This is not usually nearly as satisfactory or as accurate as time study methods.

Where bonus systems are in operation two or three problems may arise. In the first place, the question must be faced as to whether bonuses likely to be earned are to be included as part of the Standard Cost. Secondly, there are a number of factors which, while ordinarily associated with direct labour, can be treated as part of the direct labour cost, and therefore included in the Standard Labour Cost, or can be transferred and treated as part of manufacturing expense.

In regard to the first matter, the question of whether bonuses should be treated as part of the Standard Cost, depends largely on the amount involved in such bonuses, and the method of time study and bonus system in operation. With the Bedaux system, for example, this problem is automatically solved, because the time set and the standard rate in operation, automatically give one the Standard Cost. With other bonus systems, this may not be so, and, depending upon what the experience has been in the past, it may be necessary to allow some amount to be included in the Standard Labour Cost.

The amount of such bonus may, however, be included as a figure in manufacturing expense, and in the second case above referred to there are a number of accounts which may be treated in this way. Again illustrating by means of a Bedaux system, the following accounts would arise out of direct labour, but may well be included in factory expense and be included in standard rates to cover such :—

Base Rate Excess,
Process Allowance,
Operators below Standard,
Overtime Excess.

Before leaving this subject, attention must again be directed to the importance of arriving at the grades of labour involved. In certain cases this may make no difference in point of actual time. For example, with an automatic machine, the time of a junior may be exactly the same as the time of a senior, and whilst it would obviously be beneficial to have a junior engaged, this may not be possible because of the limitation on the number of juniors to be employed. In other cases, whereas the time for a senior may be 3 hours, the time for a junior may be 5 hours. The difference in rates may bring the cost of the junior to about the cost of the senior.

In certain cases, where it is not possible to use a large number of rates the expedient is sometimes adopted of taking three or four average rates and using those. The rates applicable, for example, may vary with ages and it may be virtually impossible to decide the ages of employees likely to be used for the various work. In these cases, average rates may be struck and these may be used for calculation of the standard cost. Thus, there may be average rates for:—

(a) Adult males,
(b) Adult females,
(c) Junior males, other than apprentices,
(d) Junior females,
(e) Apprentices.

These rates must be carefully calculated and should be arrived at only after a very thorough examination of how the averages have worked out in previous periods. Sometimes this method can give surprisingly accurate results, but everything does depend upon the degree of care in arriving at the rates.

When both the times necessary and the grades and rates of labour are known, calculation of the Standard Labour Cost becomes merely a matter of arithmetic.

3. Setting Factory Expense Standards.

The determination of standard rates for the application of factory expense is usually a much more difficult matter than arriving at standards either in relation to materials or labour. There are two separate aspects to be considered:—

1. The preparation of lists of estimated expenses likely to be incurred during the coming period. These lists may be joined to give one overall factory rate. Alternatively, they may be kept within departments to give departmental rates, both in relation to production and service departments. The preparation of these lists involves predetermining the expenses likely to be incurred in connection with such

expenses as Supervision, Inspection, Repairs and Maintenance, Insurance, Stores Expenses, Depreciation and General Factory Expense.

2. A determination of estimates of production, which would probably have to be interpreted in relation to the number of productive units. It is this which is responsible for the great deal of attention which has had to be given to the question of capacity.

(a) *Factory Expense Estimates.*

The method of treatment here depends upon whether one overhead expense rate is to be applied for the whole business, or whether departmental rates are in operation. In the case of the former, the procedure would be to take all the expenses which have been included under Factory Expense in previous periods. It is a good plan to list these, together with the amounts involved for the last three or four periods, leaving a column for the estimated amounts for the ensuing term. The practice is somewhat simplified if the expenses are divided into three types:—

Fixed,

Fixed-Variable (sometimes called Semi-Variable),

Variable. (See Figure No. 77).

FIGURE No. 77.

FACTORY EXPENSE BUDGET.

		Last Period. £	*This Period.* £
Salaries—Supervision	F	1,560	1,600
„ —Clerical	F	980	980
„ —Stores Clerical	F	870	900
Watchmen	F	550	550
Cleaners...	F	400	410
Depreciation	F	4,300	4,100
Rates & Taxes	F	260	265
Fire Insurance...	F	280	300
Power & Light	FV	950	1,010
Heat & Water	FV	320	350
Inspection	FV	640	680
Material Handling	FV	620	640
Welfare...	FV	480	520
Materials & Supplies...	V	1,150	1,250
Paid Holidays...	V	2,400	2,650
Indirect Labour	V	2,350	2,070
Repairs & Maintenance—Buildings	V	200	180
„ „ „ —Plant & Equipment	V	2,800	3,000
„ „ „ —Tools	V	1,500	1,150
Spoilage...	V	450	680
Reclamation Labour	V	220	290
		£23,280	£23,575

Usually the fixed expenses would be the same from year to year, though this depends upon whether any major change has been made in relation to those factors affecting fixed expenses. Fixed-Variable Expenses are very often made up of a fixed portion and a variable portion, and it may be possible to concentrate upon the variable portion. The trend of each item of expense over the previous periods should be examined, due note also being taken of the productive output over those periods. Two considerations should then ensue. Firstly, whether there would be likely to be any increase in the expense itself, and, secondly, whether the productive capacity of the plant is likely to be increased or decreased, thus affecting the expense.

These factors also operate in relation to the variable expenses, and can be illustrated in the case of higher insurance on stock. In the past, the premium for this insurance may have been £100 made up of an insurance risk covering £100,000 worth of stock at 2/- per £100. An examination of all factors may yield these two relevant matters—firstly, that the insurance company has now increased the rate to 2/3 per £100, and, secondly, that the stock figure of £100,000 will be correct for the first six months, but during the last six months, because of shipments becoming due, and taking into account the materials going into production, it is anticipated that the figure will increase to £120,000. The amount to be allowed for insurance would therefore be calculated as under:—

£100,000 of insurance at 2s. 3d. per £100 for six months	£56	5	0
£120,000 of insurance at 2s. 3d. per £100 for six months	£67	10	0
	£123	15	0

In place of the previous figure of £100, the amount to be allowed for the coming year will be increased to £123/15/-. This method of approach would be adopted in relation to every expense, until a complete budget of expenses for the coming year had been completed.

When there are a number of producing and servicing departments involved, however, the position is much more difficult. Some expenses arise within a department itself and only affect that department, while others arise within the whole of the business and have to be apportioned to the various sections. This provides a method of approach, inasmuch as the various departments can be listed and the various expenses which arise within those departments can be transferred. The remainder of the expenses would also be listed and would be apportioned on some acceptable basis. Here again, it is necessary to take some account of what has happened in the past and to examine the relevant data in the light of production and changes for the future.

The ultimate object of the accumulation of all overhead expenses is to apportion these finally to the production departments. It is first necessary, however, to accumulate the expense relating to service departments. It will be remembered that when dealing with pre-determined expense rates (see Chapter 9) the various expenses were accumulated to all the relevant departments and then the service department expenses were transferred to the production departments on an acceptable apportionment basis. With Standard Costs, however, there is much to be gained from the provision of standards in relation to the service departments, and this can best be accomplished by having standard rates applicable to the service departments, and using those standard rates for apportionment to the production departments. Thus it may be anticipated that the expenses of the powerhouse and the demands on it may be such that, if both estimates were realised, the cost of power would be, say, 2d. per unit. It may, therefore be decided to treat the 2d. per unit as a standard rate and irrespective of the ultimate costs of the powerhouse, charge all units used by the production departments to them at 2d. per unit. If, therefore, the powerhouse expense exceeds the estimates, the variance will be shown. In the case of power, however, there would be the additional factor of the amount of power estimated to be used, and the amount actually used. A consideration of this factor comes under the heading of capacity.

(b) *Capacity Factors.*

While it is necessary to know the total amount of expense, obviously one of the most important factors in arriving at such estimates is the productive capacity level at which these estimates should be calculated. It is axiomatic that the expenses necessary to produce 2,000 units would not be as great as to produce 10,000 units. The difference in the proportions would depend upon the degree of fixed and semi-variable expenses involved. One of the first things to decide therefore is the level of activity at which the expenses must be estimated. This matter is considered in some detail in Chapter 31, but it is necessary to give some preliminary consideration to the matter now, so that the full implication in relation to standard expense rates can be understood.

The following levels of activity can be used:—

1. Expected actual.
2. Desirable actual.
3. Expected normal.
4. Capacity to produce.
5. Capacity to sell.
6. Normal level for the industry.
7. Long term average.

There are a number of others, which may be adopted by particular organisations where special circumstances have to be taken into account. The question of the desirable level of activity is one which has constantly exercised the minds of cost accountants. It is impossible to lay down any generally accepted rules, though a big step forward was made when the National Association of Cost Accountants of U.S.A. arranged for a questionnaire to be distributed amongst 224 companies to ascertain the most common practices in operation. A number of factors were investigated, but in connection with the calculation of expense rates, an important attempt was made to ascertain the most commonly favoured method of approach. Of the 224 companies, it was found that 18 or approximately 8% used actual rates, which were determined at the end of the accounting period by spreading the actual expense over the actual production. Of those that used predetermined rates, an attempt was made to ascertain the basis of predetermination. The N.A.C.A. made the important distinction of bases relating to normal capacity, normal utilisation of plant, or normal sales expectancy. The use of the term "normal capacity" itself has created confusion in the past, though its two most common meanings would cover normal utilisation of plant or normal sales expectancy.

The result of the questionnaire showed that of 172 companies, 5 based their rates on estimated production covering ability to produce only, 44 companies used a basis of ability to produce and sell, 34 companies used normal capacity based on ability to produce only, and 89 on normal capacity, based on ability to produce and sell.

The questionnaire was further designed to obtain information as to which factors were the most common in arriving at normal capacity. Where such normal capacity was based on ability to produce only, the practical capacity of the whole plant was by far the most important factor. In the case of normal capacity based on the ability to produce and sell, the main factors governing a decision were much more varied. Whilst practical capacity of the whole plant was still the most common factor, the anticipated sales for the period under review was almost as much favored, and the average sales experience for a number of past years was also very frequently taken into account.

It will be seen from the diversity of opinions that this is a matter which calls for individual judgment in the case of each organisation. It is important to note, however, that the expected level of activity chosen as the basis for the capacity factors necessary to arrive at expense rates need not be applied to the calculation of either material or labour standards. Thus, both material and labour can be calculated on a basis of expected actual, whilst expense can be determined in terms of expected normal capacity.

Procedure for Calculation of Standard Expense Rates.

The procedure to be adopted for determining standard expense rates can therefore be summarised as under:—

1. Determine the level of operations for :-
   (a) Producing Departments,
   (b) Service Departments.
2. Calculate the fixed, semi-variable and variable expenses applicable to each production department at the determined level of operations.
3. Calculate the fixed, semi-variable and variable expenses applicable to each service department at the determined level of operations.
4. Calculate a standard unit cost for each service department which can be applied to production departments.
5. Calculate a standard expense rate for each production department.

In calculating the expense rates for a production department a number of factors may be used. This matter was fully considered in Chapter 8. The most commonly accepted basis is the direct labour hour, and if this was adopted the standard rate would be calculated according to the following formula:—

$$\frac{\text{The total estimated factory expense for the period}}{\text{Calculated standard labour hours for the period.}}$$

This formula can be used for the business as a whole or for individual departments, where there are no charges for service departments to be added to the ordinary departmental rates.

Where the latter is the case, the standard rate for the department is arrived at according to the following formula:—

$$\frac{\text{The total estimated factory expense for the period}}{\text{Calculated standard labour hours for the period}}$$
$$\text{Plus}$$
$$\frac{\text{Standard costs of service departments at expected level of use}}{\text{Calculated standard labour hours for the period.}}$$

Use of Fixed and Variable Rates.

With the division of expenses into fixed and variable (the latter including semi-variable) it is possible to calculate two rates, one applicable to fixed expense and the other to variable expense. There are occasions when this would give a much more accurate picture, particularly in relation to some service departments. This matter is fully considered in Chapter 31.

4. Revision of Standards.

This question is an important one in the case of current standard cost systems, but it is not nearly as important in the basic method. If Standard Costs are to be used by management in the determination of production and sales policies, they must be reasonably accurate and must set forth a reasonable point of view. This is, therefore, an argument in favour of constantly watching the standards to see that changes do not seriously reduce their validity. If this is not so, management may be seriously misled. On the other hand, as pointed out previously, there may be a great deal of painstaking work necessary in arriving at standards, and constant changes may not only seriously overburden the cost accounting staff, but may also seriously reduce the effective nature of Standard Costs. Constant changes reduce the value to be expected from cost comparisons, and constantly shifting bases may confuse management.

The question of the interpretation of variances might suffer from not altering the standards when they should be altered or, alternatively altering them when they should not be altered. Out of this dilemma, however, a way must be found, though the solution can only come after a study of the individual circumstances involved. A generalisation can only be made in the following way—that if changes occur which have the result of altering the standard so that their value to management is largely lost, or what is more serious, that their interpretation may be misleading to management, they should be altered. On the other hand, if their value is not seriously impaired and there is no question of misconception, it is usually better not to make the alteration.

Very often it is contended that no change should be made in material quantity standards unless there is an alteration in the material to be used or the method of production. If, however, a mistake was made in the original standard, and it was of serious consequence, the sooner it is altered the better.

In the case of material prices, if care is exercised in the initial estimates, there should be no occasion for the alteration of the standard price during the accounting period affected. This rule, whilst of general application, may, of course, be altered where circumstances are exceptional.

In the case of labour standards, careful calculation at the outset should obviate the necessity for change, though here again an alteration in the productive method would probably force a re-consideration of the figures.

The circumstances necessitating an alteration in labour rates would have to be exceptional, though an important rise or fall in the basic wage may be sufficient. In this country, the decision of the Women's Employment Board, whereby female workers, previously on female rates would be increased to 90% of the male labour rate, may quite well warrant a reconsideration of standards.

There should be a constant aim on the part of technicians to improve productive methods, and if this improvement takes place, the cost accountant should not act as a deterrent by refusing to alter Standard Costs. Rather should he co-operate with the technician, and amend the standards where a change in the productive method renders the old cost obsolete. In fact, under a sound system of Standard Costs, work-

ing from product standards and actuals to income statements, setting forth standard profits with additions or deductions for variances, there is not much dislocation in altering standards, providing that care is taken in following the transactions through. However, again to generalise, the matter can probably best be summed up by saying that the attitude of the cost accountant should be to remember that Standard Costs (like all costs) are prepared for the benefit of management, and whenever the cost accountant sees that management's aims can be best served by an alteration of standards he should immediately give effect to that process which will alter such standards.

5. Standard Cost Cards.

When standard costs relating to material, labour and expense have been determined, the cost of each product is set out on a Standard Cost Card, and these rates are used for the calculation of total Standard Costs and the comparison of such with total Actual Costs to arrive at the variations in relation to each product manufactured. An example of a Standard Cost Card is to be found in Figure No. 78.

FIGURE No. 78.

STANDARD COST CARD.

L124—Socks—10½″.

Date........................ *Machine* ....
Specification..
Pattern ....

Materials—Yarn.

Yarn.	Count.	Quality.	Regd. Weight.	Cost per lb.	Cost per Doz. £	s.	d.
White Wool	1/23	60	8.00 ozs.	5/-	0	2	6
,,	1/23	60	1 lb.4.00 ozs.	5/-	0	6	3
,,	1/23	60	8.00 ozs.	5/-	0	2	6
,,	1/26	60	4.00 ozs.	5/-	0	1	3
,,	1/45	64	2.00 ozs.	6/-	0	0	9
					0	13	3
				Less Waste	0	0	9
				Total	0	12	6

Labour and Overhead—

Operation.	Direct Labour Units per doz.	Stand. Base Rates.	Direct Labour Cost per doz.	Unit Overhead Rate.	Overhead per doz.	Total per Doz.
Knitting Tops	6	50/-	1.12	.5327	3.196	4.316
Knitting	50	50/-	12.63	.516	25.8	38.43
Mending	10	50/-	2.41	.282	2.82	5.23
			16.16		31.816	47.976
Looping	20	70/-	4.85	.302	6.04	10.89
Inspecting	8	60/-	2.11	.302	2.416	4.526
Mending	2	60/-	.33	.302	.604	.934
Batching			.35			.35
			7.64		9.060	16.700

Operation.	Direct Labour Units per doz.	Stand. Base Rates.	Direct Labour Cost per doz.	Unit Overhead Rate.	Overhead per doz.	Total per Doz.
Boarding	12	100/-	4.66	.685	8.22	12.88
Examining	3	60/-	.50	.241	.723	1.223
Mending	4	60/-	.84	.241	.964	1.804
Pair and Fold	4	60/-	.96	.241	.964	1.924
Stamps Hose	2	20/-	.18	.241	.482	.662
Stitching	3	30/-	.42	.241	.723	1.143
Boxing	2	60/-	.41	.241	.482	.892
Sundries	8	60/-	1.52	.241	1.928	3.448
Deliver W/house	1	60/-	.03	.241	.241	.271
			9.52		14.727	24.247
			33.32		55.603	88.923
						7.4.923
Cost of Dyeing—as per Standard Rate						1.1.277
Cost of Materials—Yarn						12.6
Sundry Materials						.20
Layer Boards and Transfers						.90
Standard Cost of Manufacture—per Dozen.						21/1.3

It will be noted that the various materials and operations are set out in detail, so that calculation of variances can be determined in relation to each type of material or each labour operation. This facilitates an examination of the causes for such variation. Where parts are first produced and these are subsequently welded into sub-assemblies and ultimately into final assemblies, standard cost cards are made out for the sub-assemblies and the final assemblies. Here again the cost cards show the various materials or sub-assemblies involved, together with the labour operations necessary thereon.

CHAPTER 19.

ESTIMATE COSTS.

Before proceeding to a study of Standard Cost Systems some attention can be paid to Estimate Cost Systems, because these have some of the features of standard costs. They do not treat the accounts in the same way as complete standard cost systems, but are rather a half-way measure designed to give some of the advantages of standards, but to avoid much of the clerical work in the inauguration of a complete standard cost system.

They are therefore of value where for various reasons a complete cost system might not be possible. For example, it may be realised that a complete standard cost system may give very desirable advantages, but the cost involved may prevent its adoption. In addition, in some industries it may be somewhat difficult to use the standard cost system, even though estimates of the cost of products to be manufactured must be made before manufacture, to facilitate the quotation of prices. Management may therefore decide that it must know when the work is completed how the actual costs have compared with the estimates, and may desire the variations to be disclosed in the accounts. The general accounting system may thereupon be designed to show these variations between the estimates and the actuals, without going to the expense of a full standard cost system, and without getting all the information which would be available from the latter.

Usually the most important factor is to exhibit the variations with as little clerical work as possible, and therefore the number of accounts and forms are kept to the minimum.

Accounting Procedure.

The following would be the steps to be taken under a system of Estimate Costs:—

1. Charge actual materials, labour and factory expense to the Work in Process Account or accounts, as used or incurred.

   This would involve a Raw Materials Account and a Work in Process Account. The latter may be divided into Materials in Process, Labour in Process and Factory Expense in Process. The Raw Materials Account would usually be supported by a Raw Materials Ledger, but the important difference as against the usual method of job order costing, is that cost sheets would usually be eliminated to reduce the clerical work involved. The method of accumulation of the various elements of cost would not differ from those explained in previous chapters. Materials cost would be obtained by requisitions, priced upon an accepted basis. Labour costs would be calculated through the time tickets, and at the actual rates applicable. Factory expense would be accumulated in the ordinary way and charged through journal entries.
2. List in the form of a summary completed products, and estimate the cost of goods sold.

In order to record the goods completed, a daily summary should be prepared, setting forth the various types of goods completed and included in this form will frequently be found the estimated costs of material, labour and expense. Where these values are inserted, there is a running total showing the estimated value of goods completed.

In addition to this summary a record must be made of the cost of goods sold. This would involve the number of units of each product sold during the period, together with the estimated unit cost of each product, thus enabling the total estimated cost of each product to be calculated. The addition of all estimated costs would give the total estimated cost of all goods sold. Here again estimates are used.

A third summary necessary is that of work in process. At the close of each period, the quantity of each product in process is calculated, and a total estimate of the value of the work in process is arrived at by the insertion of estimated unit costs relating to material, labour and expense. The estimated work in process can, where desirable, be divided into material in process, labour in process and factory expense in process. Quantities may be obtained either by an examination of the records, viz., material requisitions and time cards, or, where the quantities lend themselves to such treatment, by a physical stocktaking.

3. Ascertain the variations between estimated and actual costs for the period.
4. Dispose of these variations through the accounts.

These last two factors are discussed in more detail in the example of Estimate Costs treated hereunder:—

EXAMPLE.

The Perfection Manufacturing Company manufactures only one product and the estimated cost of such is:—

Materials	£4
Labour	£3
Expense	£2
Total	£9

The opening stock of raw materials amounted to £5,000, and during the month additional raw materials totalling £4,000 were purchased.

Materials were charged into production by means of materials requisitions in the ordinary way and a summary of these shows that £2,530 have been charged into production.

The usual time cards and methods of recording labour are employed and a payroll summary for the month discloses that the value of labour charged into production during the period was £1,848.

The various items making up Factory expense are accumulated in the usual manner, and the total of these at the end of the month is £1,265.

During the period 500 units of product were completed, and 400 were sold. The selling price was £12 per unit.

At the end of the month there are 100 units in process, and as the result of a survey, it is learned that 75% of the materials necessary to complete the units in process have been used and the units are 50% complete in relation to labour and factory expense.

From the foregoing the estimated cost of the goods produced could be calculated:—

Material—500 units at £4	£2,000
Labour — „ „ „ £3	£1,500
Expense— „ „ „ £2	£1,000
Total	£4,500

The estimated cost of the goods sold during the period would be:—

Material—400 units at £4...	£1,600
Labour — „ „ „ £3...	£1,200
Expense— „ „ „ £2...	£ 800
Total	£3,600

The selling price of the products sold would be:—

400 units at £12	£4,800

The Estimated Value of Work in Process can be stated as follows:—

Materials—100 units—75% complete at £4	£300
Labour — „ „ 50% „ „ £3	£150
Expense — „ „ 50% „ „ £2	£100
Total	£550

The Journal entries necessary to give effect to the foregoing would be:

(1)

Raw Materials	£5,000	
To General Ledger Control A/c.		£5,000

(Being opening stock of raw Materials at actual cost.)

(2)

Raw Materials	4,000	
To General Ledger Control A/c.		4,000

(Being purchases of raw materials at actual cost.)

(3)

Materials in Process	2,530	
To Raw Materials		2,530

(Being actual cost of raw materials charged into production, as per materials requisition summary.)

(4)

Labour in Process	1,848	
To General Ledger Control A/c.		1,848

(Being actual cost of labour incurred in production as per payroll summary.)

(5)

Factory Expense in Process	1,265	
To General Ledger Control A/c.		1,265

(Being actual factory expense incurred as per expense summary.)

It should be noted from the foregoing that the Raw Materials A/c is kept in terms of actual costs, both for debit and credit entries. The balance of Raw Materials A/c would therefore show the actual value of Raw Materials on hand. Depending upon the size and complexity of the business, the balance of this account may be supported by individual accounts in a Raw Materials Ledger. The three work in process accounts have been charged with their respective cost elements in line with actual figures. The debits are actuals. As will be seen from the following entries, however, the credits are at estimated costs, viz.:—

(6)

Finished Goods	4,500	
To Materials in Process		2,000
Labour in Process		1,500
Factory Expense in Process		1,000

(Being estimated cost of goods completed during the month, as per summary of finished goods) viz.—

	Units	Per Unit	Amount
Material	500	£4	£2,000
Labour	500	3	1,500
Factory Expense...	500	2	1,000
		£9	£4,500

(7)

Cost of Sales	£3,600	
To Finished Goods		£3,600

(Being cost of sales, as per summary of goods sold, viz., 400 units at £9—£3,600.)

It should be noted from the foregoing that the work in process accounts have now been credited with the estimated cost of the goods completed. The corresponding entry being in the finished goods account, this is also debited at the estimated cost and out of this account is credited the finished goods that have been sold, again calculated at estimated cost. At this stage therefore finished goods account shows a balance representing the number of units still on hand, calculated at the estimated cost.

(8)

Stock Clearing A/c.	£550	
To Materials in Process		£300
Labour in Process		150
Factory Expense in Process		100

(Being estimated value of work in process at the end of the month calculated as under :—

Materials—100 units—75% complete—at £4 ...	£300
Labour — ,, ,, 50% ,, ,, £3 ...	150
Expense — ,, ,, 50% ,, ,, £2 ...	100
Total	£550)

(9)

General Ledger Control A/c	£4,800	
To Sales		£4,800

(Being 400 units of product sold @ £12 per unit actual.)

The foregoing entries would then be posted to the Ledger as under:—

RAW MATERIALS A/c.

Jan. 1	To Opening Stock (Actual) (1) ...	£5,000	Jan. 31	By Transfers to Production (Actual) (3) ...	£2,530
,, 31	,, Purchases (Actual) (2) ...	4,000			

MATERIALS IN PROCESS A/c.

Jan. 31	To Raw Materials (Actual) (3) ...	£2,530	Jan. 31	By Finished Goods (Estimated) (6)...	£2,000
			,, 31	,, Stock in Process (Estimated) (8) ...	300

LABOUR IN PROCESS A/c.

Jan. 31	To Payroll Summary (Actual) (4) ...	1,848	Jan. 31	By Finished Goods (Estimated) (6) ...	1,500
			„	Stock in Process (Estimated) (8) ...	150

FACTORY EXPENSE IN PROCESS A/c.

Jan. 31	To Factory Expenses Summary (Actual) (5)	1,265	Jan. 31	By Finished Goods (Estimated) (6) ...	1,000
			„	Stock in Process (Estimated) (8) ...	100

STOCK CLEARING A/c.

Jan. 31	To Closing Stocks in Process (8) (Estimated)	550			

FINISHED GOODS A/c.

Jan. 31	To transfers from Work in Process (Estimated) (6) ...	£4,500	Jan. 31	By Goods Sold (Estimated) (7) ...	£3,600

COST OF SALES A/c.

Jan. 31	To Goods Sold (Estimated) (7) ...	£3,600			

SALES A/c.

			Jan. 31	By Goods Sold (Actual) (9)	£4,800

GENERAL LEDGER CONTROL A/c.

Jan. 31	To Sundry Drs. (Actual) (9) ...	£4,800	Jan. 31	By Raw Materials Stock (Actual) (1) ...	£5,000
			„ 31	„ Raw Materials Purchases (Actual) (2)	4,000
			„ 31	„ Labour Charges (Actual) (4) ...	1,848
			„ 31	„ Factory Expense (Actual) (5) ...	1,265

It will be noted that the work in process accounts shown above do not balance. There are debit balances in each account, because the actual cost of production has in each case exceeded the estimated cost of production. This is shown in the following statement:—

COST OF PRODUCTION.

	Actual (Debits)	Estimated (Credits)	Variation from Estimated Cost
Materials	£2.530	£2,300	£230
Labour	1,848	1,650	198
Factory Expense	1,265	1,100	165
	£5,643	£5,050	£593

These variations all show the actual in excess of the estimated. The journal entry to record these variations would be:—

(10)

Variations from Estimated Cost	£593	
To Materials in Process A/c.		£230
Labour in Process A/c.		198
Factory Expense in Process A/c.		165

(Being variations in Work in Process, transferred from process accounts.)

The foregoing entry would have the effect of closing the work in process accounts, leaving no balance. The estimated amount of work in process, however, still appears in the Stock Clearing A/c., and the excess amounts spent in production in the Variation from Estimated Cost A/c. In order to record the work in process for the next period, entry number (8) is reversed, viz.:—

(11)

Materials in Process	£300	
Labour in Process	150	
Factory Expense in Process	100	
To Stock Clearing A/c.		£550

(Being opening work in process for the new period at estimated cost.)

Up to this stage, the profit position would appear as under:—

Sales (Actual)	£4,800
Less Cost of Sales (Estimated)	3,600
Balance	£1,200

There are, however, variations of £593 to be taken into account, and a decision must be made as to the best method of treating these. The following methods may be used:—

1. *Charge the variations to cost of sales.*

This method is usually adopted where the variations have been caused by carelessness, waste or other factors for which the factory is responsible. The entry would be:—

(12)

Cost of Sales A/c.	£593	
To Variation from Estimated Cost A/c.		£593

(Being amount of variations transferred to cost of sales.)

The profit position would then appear :—

Sales (Actual)	£4,800
Less Cost of Sales	4,193
Gross Profit on Sales	£607

2. *Transfer the Variations to Profit and Loss A/c.*

This treatment would be adopted where the factory was not responsible for the excess cost, but this grew out of idle time or other factors over which the factory had not control. The entry would be:—

(13)

Profit and Loss A/c.	£593	
To Variations from Estimated Cost A/c.		£593

(Being transfer of variations to Profit & Loss A/c.)

In the Cost Ledger (as above) the debit entry would be to General Ledger Control A/c., but would through this account find its way into the Profit and Loss A/c. in the General Books.

The profit position would then be:—

Sales (Actual)	£4,800
Less Cost of Sales	3,600
Gross Profit on Sales	1,200
Less Profit & Loss Exs.	—
„ Variations from Estimated Cost	593
	£ 607

3. *Apportion and write off the variations to cost of sales and stocks in process.*

Under the first method the variations were transferred outright to cost of sales, so that there would be a deduction of the whole amount of the variation from the profit of the period, and no allowance for the faulty condition would find its way into the stock in process accounts. It may be, however, that the variations have resulted not so much from carelessness in the factory, but from conditions (not idle time) over which the factory had no control and which did not represent inefficiency. To take an extreme case, there may have been an error in calculating the estimated prices, and it may be desirable to adjust the stock in process and finished goods as well as the cost of sales. In order to do this, it is necessary to arrive at the percentage variation relating to each element of cost, and then to increase or decrease (in this case increase) the cost of sales, finished goods, and stock in process accounts accordingly. This would be calculated as follows:—

Material Variation.

Estimated Cost Completed Units.	Estimated Cost Process Stock.	Total Estimated Cost.	Total Actual Cost.	Total Variance.	Variance on Estimate.	% of Variance on Estimate.
£2,000	£300	£2,300	£2,530	£230	$\frac{230}{2,300}$	10%
Labour Variation.						
£1,500	£150	£1,650	£1,848	£198	$\frac{198}{1,650}$	12%
Factory Expense Variation.						
£1,000	£100	£1,100	£1,265	£165	$\frac{165}{1,100}$	15%

It now becomes possible to calculate a new cost of the product, viz.:—

	Old Estimate	Plus Adjustment	New Cost
Materials	£4	10%	£4 8 0
Labour	£3	12%	3 7 2.4
Expense	£2	15%	2 6 0
		Total Cost	£10 1 2.4

It now becomes possible to amend the cost of goods sold, which now appears as follows:—

Material—400 units at £4 8 0	£1,760
Labour „ „ „ 3 7 2.4	1,344
Factory Ex. „ „ 2 6 0	920
	£4,024

Similarly, the Finished Goods Stock can be shown at the amended figure:—

	£	s.	d.		
Material—100 units at	£4	8	0	£440	
Labour „ „ „	3	7	2.4	336	
Expense „ „ „	2	6	0	230	
					£1,006

The adjustment of the work in process account gives the following results:—

		£	s.	d.		
Material—100 units—75% complete at		£4	8	0	£330	
Labour „ „	50% „ „		3	7	2.4	168	
Expense „ „	50% „ „		2	6	0	115	
						£613

The full statement of the variations would appear as under:—

	Original Estimate	Amended Estimate	Variation
Cost of Goods Sold	£3,600	£4,024	£424
Finished Goods	900	1,006	106
Work in Process	550	613	63
Totals	£5,050	£5,643	£593

The journal entry necessary to give effect to the foregoing would be:—

(14)

Cost of Sales	£424	
Finished Goods	106	
Materials in Process	30	
Labour in Process	18	
Factory Expense in Process	15	
To Variation from Estimated Cost		£593

(Being adjustment of cost of sales, finished goods and work in process accounts to absorb variations.)

This would mean that the profit statement would appear:—

Sales (Actual)	£4,800
Less Cost of Sales	4,024
Gross Profit on Sales	£ 776

Alternatively, the adjustment of the cost of sales need not be included in the journal entry, which would then appear:—

Finished Goods	106	
Materials in Process	30	
Labour in Process	18	
Factory Expense in Process	15	
To Variation from Estimated Cost		£169

(Being adjustment of finished goods and work in process accounts to absorb proportionate variation.)

In this case the profit statement would show:—

Sales (Actual)		4,800
Less Cost of Sales	3,600	
Add Variation from Estimated Cost	424	4,024
Gross Profit on Sales		£ 776

After these adjustments have been posted to the various accounts, the latter would appear as follows:—

RAW MATERIALS A/c.

Jan. 1	To Opening Stock (Actual) (1) ...	£5,000	Jan. 31	By Transfers to Production (Actual) (3) ...	£2,530
„ 31	„ Purchases (Actual) (2)	4,000	„ 31	„ Balance c/d.... ...	6,470
		£9,000			£9,000
Feb. 1	To Balance b/d. ...	£6,470			

MATERIALS IN PROCESS A/c.

Jan. 31	To Raw Materials (Actual) (3) ...	£2,530	Jan. 31	By Finished Goods (Estimated) (6)	£2,000
				„ Stock in Process (Estimated) (8) ...	300
				„ Variation from Estimate (10)	230
		£2,530			£2,530
Feb. 1	To Stock Clearing A/c. Opening work in Process (11) ...	£300			
	„ Adjustment of Estimate (14)	30			

LABOUR IN PROCESS A/c.

Jan. 31	To Payroll Summary (Actual) (4) ...	1,848	Jan. 31	By Finished Goods (Estimated) (6)	1,500
				„ Stock in Process (Estimated) (8) ...	150
				„ Variation from Estimate (10)	198
		£1,848			£1,848
Feb. 1	To Stock Clearing A/c. Opening Work in Process (11) ...	150			
	„ Adjustment of Estimate (14)	18			

FACTORY EXPENSE IN PROCESS A/c.

Jan. 31	To Factory Expense Summary (Actual) (5)...	1,265	Jan. 31	By Finished Goods (Estimated) (6)	1,000
				„ Stock in Process (Estimated) (8) ...	100
				, Variation from Estimate (10)	165
		£1,265			£1,265
Feb. 1	To Stock Clearing A/c. Opening work in Process (11) ...	100			
	„ Adjustment of Estimate (14)	15			

VARIATION FROM ESTIMATED COST A/c.

Jan. 31	To Materials in Process (10)	230	Jan. 31	By Stock Adjustment (14)	593
„ 31	„ Labour in Process (10)	198			
„ 31	„ Factory Expense in Process (10) ...	165			
		£593			£593

STOCK CLEARING A/c.

Jan. 31	To Closing Stocks in Process (Estimated) (8)	550	Jan. 31	By Transfer to work in process A/cs. (11)...	550
		£550			£550

FINISHED GOODS A/c.

Jan. 31	To transfers from Work in Process (Estimated) (6)	4,500	Jan. 31	By Goods Sold (Estimated) (7)	3,600
	„ Adjustment Estimated Cost (14) ...	106		„ Balance c/d. ...	1,006
		£4,606			£4,606
Feb. 1	To Balance b/d. ...	£1,006			

COST OF SALES A/c.

Jan. 31	To Goods Sold (Estimated) (7)	£3,600			
	„ Adjustment Estimated Cost (14) ...	424			

SALES A/c.

			Jan. 31	By Goods Sold (Actual) (9)	£4,800

GENERAL LEDGER CONTROL A/c.

Jan. 31	To Sundry Drs. (Actual) (9)	£4,800	Jan. 31	By Raw Materials Stock (Actual) (1)... ...	5,000
				„ Raw Materials Purchases (Actual) (2)...	4,000
				„ Labour Charges (Actual) (4)... ...	1,848
				„ Factory Expense (Actual) (5)... ...	1,265

The foregoing is a simple illustration of the principles underlying Estimated Costs. In this case three Work in Process A/c's have been used, though one account could be used to control the three elements if desired. Though the principles are the same, the treatment becomes much more complex where a number of departments are affected. Obviously, there would be a necessity to take into account the variations between estimates in relation to each department and it may be that there would be over allowances made in some cases and under allowances in others. Each department would be treated in the same way as a complete business, and as shown in the foregoing accounts. The number of products can also make the position somewhat more complex, but really only to the extent of increasing the work necessary to arrive at the variations between the actual and the estimated figures.

Estimated Costs embody some of the principles of acceptable systems of Standard Costs, and really represent a crude Standard Cost method. Whilst open to objections, they can be very useful in certain cases, and can give to management an overall check without the refinements possible through more scientific methods embracing standards.

CHAPTER 20.

IDEAL STANDARD COSTS.

COST ACCOUNTING PROCEDURE.

FIRST METHOD.

There are three main methods of Standard Costs. The important distinguishing factor in each is:—

First Method.

Work in Process is debited with Actual Cost and credited with Standard Cost of Production.

Second Method.

Work in Process is debited with Standard Cost and credited with Standard Cost of Production.

Third Method.

Work in Process is debited with both Actual and Standard Cost and also credited with Actual and Standard Cost of production.

The first two methods are of the Ideal or Current type of Standard Costs and the third is the distinguishing feature of Basic Standard Costs.

It is now proposed to examine each of these methods in turn and an essentially simple illustration is taken to show the principles involved in each method. The same figures are preserved throughout, so that the essential differences between the three methods should be easily grasped. Whilst the illustration has been purposely kept simple, it is typical of the approach which can be made under each method, even where complexities resulting from a large number of lines or departments are involved.

EXAMPLE.

The Liberty Production Company produces only one comparatively simple product. It operates a Standard Cost system, and, as an essential preliminary, ascertained the Standard Cost of this product. The Standard Cost Card, giving these particulars is shown hereunder:—

STANDARD COST CARD.
PRODUCT "S."
(Budgeted monthly Production Hours—2,400.)
(Budgeted monthly Production—120 complete units).

Materials—10 pieces "a" at 5/-	£2 10 0	
8 „ "b" „ 4/-	1 12 0	
15 „ "c" „ 2/-	1 10 0	
		£5 12 0
Labour—20 hours @ 3/-		3 0 0
Factory Expense—20 hours at 4/-		4 0 0
Standard Cost per Unit		£12 12 0

The Factory Expense Rate has been arrived at by calculating the amount of expense which could be treated as standard for the month and which has been estimated to be £480, and dividing this by the standard hours for the month, viz., 2,400. The resultant rate is 4/- per hour.

The stock on hand of Raw Materials at the beginning of the period is as follows:—

650 pieces "a" at 5/-	£162 10 0	
500 „ "b" „ 4/-	100 0 0	
1,000 „ "c" „ 2/-	100 0 0	
		£362 10 0

During the month the following purchases are made:—

1,000 pieces of "a" @ 5/3	262 10 0	
800 „ „ "b" „ 3/10	153 6 8	
2,000 „ „ "c" „ 2/-	200 0 0	
		£615 16 8

Raw Materials requisitions have been summarised and the summary shows that the following have been charged in to production:—

650 pieces of "a" @ 5/-	162 10 0		
600 „ „ "a" „ 5/3	157 10 0		
		320 0 0	
500 „ „ "b" „ 4/-	100 0 0		
440 „ „ "b" „ 3/10	84 6 8		
		184 6 8	
1,800 „ „ "c" „ 2/-		180 0 0	
			£684 6 8

A summary of time cards, as entered in the payroll summary, discloses that the following labour has been used in production:—

1,000 Direct Labour hours at 3/- per hour	150 0 0	
1,250 „ „ „ „ 2/10 „ „	177 1 8	
		£327 1 8

As indicated previously the budgeted factory expense is £480, whilst the actual expense incurred amounts to £475.

During the month, 100 units of product "S" are completed, and, at the end of the period, 20 units are still in process covering which all materials have been passed through to production, and 50% of Labour and Factory Expense have gone into the work.

The journal entries to give effect to the above are shown hereunder:—

(1)

Raw Materials	£362 10 0	
To General Ledger Control A/c....		362 10 0

(Being opening stock of Raw Materials.)

(2)

Raw Materials	615 16 8	
To General Ledger Control A/c....		615 16 8

(Being purchases of raw material made during the month.)

(3)

Materials in Process	684 6 8	
To Raw Materials		684 6 8

(Being actual cost of materials used in production, as per requisition summary.)

(4)

Labour in Process	327 1 8	
To General Ledger Control A/c....		327 1 8

(Being actual cost of labour used in production, as per payroll summary.)

(5)

Factory Expense in Process	475 0 0	
To General Ledger Control A/c....		475 0 0

(Being actual factory expense incurred during the month, as per expense summary.)

(6)

Finished Goods	1,260 0 0	
To Materials in Process		560 0 0
Labour in Process		300 0 0
Factory Expense in Process		400 0 0

(Being standard cost of goods completed during the month, as per finished goods summary, viz. :—

	Units.	Per Unit.	Amount	
Materials	100	£5 12 0	560 0 0	
Labour	100	3 0 0	300 0 0	
Expense	100	4 0 0	400 0 0	
				£1,260 0 0)

(7)

Work in Process Clearing A/c.	182 0 0	
To Materials in Process		112 0 0
Labour in Process		30 0 0
Factory Expense in Process		40 0 0

(Being work in process valued at standard, as under :—

	Units.	Per Unit.	Amount	
Materials—100%	20	£5 12 0	112 0 0	
Labour — 50%	20	3 0 0	30 0 0	
Expense — 50%	20	4 0 0	40 0 0	
				£182 0 0.)

During the period 90 units of completed product are sold at £18 per unit, the journal entries being:—

(8)

Cost of Sales	1,134	
To Finished Goods...		1,134

(Being cost of finished products sold during the period as under— 90 units at standard cost of £12 12 0.)

(9)

General Ledger Control A/c.	1,620	
To Sales		1,620

(Being 90 units sold at £18 per unit.)

The posting to the ledger accounts from the foregoing entries would be as follows:—

RAW MATERIALS A/c.

Jan. 1	To Opening Stock (1)	£362 10 0	Jan. 31	By Work in Process (3)	684 6 8
31	„ Purchases (2)	615 16 8			

MATERIALS IN PROCESS A/c.

Jan. 31	To Raw Materials (3)	684 6 8	Jan. 31	By Finished Goods (6)	560 0 0
				„ Work in Process (7)	112 0 0

LABOUR IN PROCESS A/c.

Jan. 31	To Payroll (4) ...	327 1 8	Jan. 31	By Finished Goods (6)	300 0 0
				„ Work in Process (7)	30 0 0

FACTORY EXPENSE IN PROCESS A/c.

Jan. 31	To Expense Summary (5) ...	475	0	0	Jan. 31	By Finished Goods (6)	400	0	0
						„ Work in Process (7)	40	0	0

FINISHED GOODS A/c.

Jan. 31	To Work in Process (6)	1,260	0	0	Jan. 31	By Cost of Sales (8)	1,134	0	0

WORK IN PROCESS CLEARING A/c.

Jan. 31	To Materials in Process (7) ...	112	0	0
	Labour in Process (7) ...	30	0	0
	Fact. Ex. in Process (7) ...	40	0	0

COST OF SALES A/c.

Jan. 31	To Finished Goods Sold (8) ...	1,134	0	0

SALES A/c.

Jan. 31	By Sundry Drs. (9)	1,620	0	0

GENERAL LEDGER CONTROL A/c.

Jan. 31	To Sales (9) ...	1,620	0	0	Jan. 31	By Opening Stock (1)	362	10	0
						„ Raw Material Purchases (2) ...	615	16	8
						„ Payroll (4) ...	327	1	8
						„ Factory Expense (5)	475	0	0

VARIATION ACCOUNTS.

An analysis of the foregoing accounts will show the following balances in the work in process accounts:—

Materials in Process—	Actual ...	£684	6	8
	Standard ...	672	0	0
	Variation ...	12	6	8
Labour in Process —	Actual ...	327	1	8
	Standard ...	330	0	0
	Variation ...	2	18	4*

* denotes actual less than standard

Factory Expense in Process—	Actual ...	475	0	0
	Standard ...	440	0	0
	Variation ...	35	0	0

It is now necessary to analyse the variations and record these in the accounts.

1. Materials Variations.

These can be of two types:—

1. The actual prices of materials may be in excess of or lower than the standard prices allowed.
2. Either more or less than the standard quantity of materials allowed may have been used.

These variations are calculated in the following manner:—

(a) Price Variation.

ACTUAL COST AS PER REQUISITIONS.

"a"	"b"	"c"
650 pieces @ 5/–...162 10 0	500 @ 4/– ...100 0 0	1,800 @ 2/–...180 0 0
600 ,, ,, 5/3...157 10 0	440 ,, 3/10... 84 6 8	
£320 0 0	£184 6 8	

STANDARD COST AS PER STANDARD COST CARD.

"a"	"b"	"c"
1,250 ,, ,, 5/–...312 10 0	940 ,, 4/– ...188 0 0	1,800 @ 2/–...180 0 0
£ 7 10 0	£ 3 13 4*	Nil

*denotes actual less than standard.

The journal entry necessary to record this price variation would be:—

(10)

Material Variation—Price	3 16 8	
To Materials in Process		3 16 8

(Being material price variation from standard.)

(b) Quantity Variation.

ACTUAL QUANTITY AS PER REQUISITIONS.

"a"	"b"	"c"
1,250	940	1,800

STANDARD QUANTITY AS PER STANDARD COST CARD.

Finished Goods—								
100 units "S" @ 10	1,000		100 @ 8	800		100 @ 15	1,500	
Work in Process—								
20 units "S" @ 10 100% complete for materials	200	1,200	20 @ 8	160	960	20 @ 15	300	1,800
Variation		50 more			20 less			Nil

The net value of quantity variation will therefore be :—

50 Units of "a" at Standard price 5/–	£12 10 0 more
20 Units of "b" at Standard price 4/–	4 0 0 less
Net Variation	£ 8 10 0 more

The journal entry to give effect to the foregoing will be :—

(11)

Material Variation—Quantity	8 10 0	
To Materials in Process		8 10 0

(Being material quantity variations from standard.)

2. Labour Variations.

There are two variations from standard labour costs—one being a price (or labour rate) variance and the other being a quantity (or efficiency) variance. These are arrived at as under:—

(a) Price or Rate Variation.

ACTUAL LABOUR COST AS PER PAYROLL.

1,000 Direct Labour Hours @ 3/–	150 0 0	
1,250 ,, ,, ,, ,, 2/10	177 1 8	
		327 1 8

STANDARD LABOUR RATE AS PER STANDARD COST CARD.

2,250 Direct Labour Hours @ 3/-		337 10 0
	Variation	£ 10 8 4*

* denotes actual less than standard.

The necessary journal entry would be—

(12)

Labour in Process	10 8 4	
To Labour Variation—Price		10 8 4

(Being value of actual labour rates less than standard.)

(b) Quantity Variation.

Actual Labour Hours, as per Payroll Summary		2,250 hours
Standard Labour Hours, as per Standard Cost Card—		
100 completed Units @ 20 hours per unit	2,000	
20 in process units @ 10 hours, being 50%	200	2,200
Variation		50 hours

The amount of the variation is therefore 50 hours at the Standard Direct Labour rate of 3/- per hour, viz.—£7 10 0. The necessary journal entry would be :—

(13)

Labour Variation—Quantity	7 10 0	
To Labour in Process		7 10 0

(Being value of excess labour over standard.)

It should be noted that the net labour in process variation is £2 18 4 less than standard, made up as under :—

Price Variation	£10 8 4 less
Quantity Variation	7 10 0 more
Net Variation	£ 2 18 4 less

3. Factory Expense Variations.

Variations from Standard Factory Expense may be analysed into:—

(a) Variation from budgeted expense.

(b) Variation through idle time, or overtime.

(c) Quantity (that is, excess or saved hours of factory expense) variation.

(a) Variation from Budgeted Expense.

This represents the difference between the amount of budgeted factory expense and the actual amount of expense incurred during the period.

Actual Factory Expense Incurred	£475 0 0
Budgeted Factory Expense	480 0 0
Variation	5 0 0*

* denotes actual less than budget.

The journal entry to give effect to this variation would be :—

(14)

Factory Expense in Process	5 0 0	
To Factory Expense Variation—Budget		5 0 0

(Being variation between actual and budgeted factory expense for the month.)

(b) Idle Time Variation.

It will be remembered that the budgeted hours for the month were 2,400, whereas the actual hours booked as direct labour were only 2,250.

There has therefore been a loss of 150 hours, presumably due to idle time. The value of this must be calculated, viz.:—

150 hours at 4/- per hour (Standard rate) ...	£30 0 0

This variation is also journalised—

(15)

Factory Expense Variation—Idle Time	30 0 0	
To Factory Expense in Process		30 0 0

(Being cost of idle time for the month.)

(c) Quantity Variation.

The hours involved in the quantity variation are the same as were shown in the quantity variation under Labour Variations—(see page 277). This showed 50 hours excess, and calculated at the standard rate of 4/- this would mean a total quantity variation of £10/-/-. The journal entry would be:—

(16)

Factory Expense Variation—Quantity	10 0 0	
To Factory Expense in Process		10 0 0

(Being the value of excess hours used during the month on production.)

Transfer of Variations.

When all variations have been calculated they are usually transferred to Profit and Loss A/c. They are generally interpreted as being due to waste or inefficiency, or, expressed in other terms, they are a cost of failure to manufacture goods at the standard previously set. Variations from Standard Costs would not be spread over cost of sales and stocks unless there had been an obvious error in setting the standards in the first place. With a Cost Ledger, these amounts would be transferred to General Ledger Control A/c. With no Cost Ledger, the journal entry to close these to Profit and Loss A/c. would be:—

(17)

Labour Variation—Price	10 8 4	
Factory Expense Variation—Budget	5 0 0	
Profit & Loss A/c.	44 8 4	
To Material Variation—Price		3 16 8
,, ,, Quantity		8 10 0
Labour Variation—Quantity		7 10 0
Factory Expense Variation—Idle Time		30 0 0
,, ,, ,, Quantity		10 0 0

(Being transfer of variations to Profit & Loss A/c.)

These variations may be shown separately from the Profit and Loss balance in any statement of profit, viz.:—

Net Profit from Operations (at standard)		£
Add Labour Price Variation	10 8 4	
Factory Expense Variation—Budget	5 0 0	15 8 4
		£
Less Material Price Variation	3 16 8	
,, Quantity Variation	8 10 0	
Labour Quantity Variation...	7 10 0	
Factory Expense Variation—Idle Time	30 0 0	
Factory Expense Variation—Quantity	10 0 0	59 16 8
Net Profit (Actual)		

Ledger Accounts.

When all these journal entries have been posted, the ledger accounts would appear as under:—

RAW MATERIALS A/c.

Jan. 1	To Opening Stock (1)	362	10	0	Jan. 31	By Work in Process (3)	684	6	8
„ 31	„ Purchases (2) ...	615	16	8		„ Balance c/d. ...	£294	0	0
		£978	6	8			£978	6	8
Feb. 1	To Balance b/d. ...	£294	0	0					

MATERIALS IN PROCESS A/c.

Jan. 31	To Raw Materials (3)	684	6	8	Jan. 31	By Finished Goods (6)	560	0	0
						„ Work in Process (7)	112	0	0
						„ Price Variation (10)	3	16	8
						„ Quantity Variation (11) ...	8	10	0
		£684	6	8			£684	6	8
Feb. 1	To Work in Process (18)	112	0	0					

LABOUR IN PROCESS A/c.

Jan. 31	To Payroll (4) ...	327	1	8	Jan. 31	By Finished Goods (6)	300	0	0
	„ Price Variation (12)	10	8	4		„ Work in Process (7)	30	0	0
						„ Quantity Variation (13) ...	7	10	0
		£337	10	0			£337	10	0
Feb. 1	To Work in Process (18)	30	0	0					

FACTORY EXPENSE IN PROCESS A/c.

Jan. 31	To Expense Summary (5) ...	475	0	0	Jan. 31	By Finished Goods (6)	400	0	0
	„ Budget Variation (14)	5	0	0		„ Work in Process (7)	40	0	0
						„ Idle Time Variation (15) ...	30	0	0
						„ Quantity Variation (16) ...	10	0	0
		£480	0	0			£480	0	0
Feb. 1	To Work in Process (18)	40	0	0					

FINISHED GOODS A/c.

Jan. 31	To Work in Process (6)	1,260	0	0	Jan. 31	By Cost of Sales (8)	1,134	0	0
						„ Balance c/d. ...	126	0	0
		£1,260	0	0			£1,260	0	0
Feb. 1	To Balance b/d. ...	£126	0	0					

WORK IN PROCESS CLEARING A/c.

Jan. 31	To Materials in Process (7) ...	112	0	0	Jan. 31	By Materials in Process (18) ...	112	0	0
	„ Labour in Process (7)... ...	30	0	0		„ Labour in Process (18) ...	30	0	0
	„ Factory Expense in Process (7)...	40	0	0		„ Factory Expense in Process (18)...	40	0	0
		£182	0	0			£182	0	0

COST OF SALES A/c.

Jan. 31	To Finished Goods Sold (8)... ...	1,134	0	0

SALES A/c.

Jan. 31	By Sundry Drs. (9)	1,620	0	0

GENERAL LEDGER CONTROL A/c

Jan. 31	To Sales (9) ...	1,620	0	0	Jan. 31	By Opening Stock (1)	362	10	0
						„ Raw Materials Purchases (2) ...	615	16	8
						„ Payroll (4) ...	327	1	8
						„ Factory Expenses (5)	475	0	0

(While called a General Ledger Control A/c, this has been treated purely as an account to which the above entries may be made. To show the operation of the entries a Profit and Loss A/c is also shown.)

PROFIT AND LOSS A/c.

Jan. 31	To Sundry Variations (balance) (17) ...	44	8	4

MATERIAL VARIATION A/c.—PRICE.

Jan. 31	To Price Variation (10)	3	16	8	Jan. 31	By P. & L. A/c. (17)	3	16	8

MATERIAL VARIATION A/c.—QUANTITY.

Jan. 31	To Quantity Variation (11) ...	8	10	0	Jan. 31	By P. & L. A/c. (17)	8	10	0

LABOUR VARIATION A/c.—PRICE.

Jan. 31	To P. & L. A/c. (17)	10	8	4	Jan. 31	By Price Variation (12)	10	8	4

LABOUR VARIATION A/c.—QUANTITY.

Jan. 31	To Quantity Variation (13) ...	7	10	0	Jan. 31	By P. & L. A/c. (17)	7	10	0

FACTORY EXPENSE VARIATION A/c.—BUDGET.

Jan. 31	To P. & L. A/c. (17)	5 0 0	Jan. 31	By Budget Variation (14)	5 0 0

FACTORY EXPENSE VARIATION A/c.—IDLE TIME.

Jan. 31	To Idle Time Variation (15)	30 0 0	Jan. 31	By P. & L. A/c. (17)	30 0 0

FACTORY EXPENSE VARIATION A/c.—QUANTITY.

Jan. 31	To Quantity Variation (16)	10 0 0	Jan. 31	By P. & L. A/c. (16)	10 0 0

An Income Statement could then be prepared as under:—

Sales		£1,620 0 0
Less Cost of Sales		£1,134 0 0
		£ 486 0 0
Add Variations (Gains)—		
Labour Price	10 8 4	
Factory Expense—Budget	5 0 0	15 8 4
		£501 8 4
Less Variations (Losses)—		
Materials Price	3 16 8	
Materials Quantity	8 10 0	
Labour Quantity	7 10 0	
Factory Expense—Idle Time	30 0 0	
„ „ Quantity	10 0 0	£59 16 8
	Profit	£441 11 8

The final Trial Balance would show the following accounts:—

Raw Materials A/c.	£294 0 0	
Materials in Process	112 0 0	
Labour in Process	30 0 0	
Factory Expense in Process	40 0 0	
Finished Goods	126 0 0	
General Ledger Control A/c.		£160 8 4
P. & L. A/c.		441 11 8
	£602 0 0	£602 0 0

The Profit and Loss A/c balance has been obtained by posting both the Sales A/c and Cost of Sales to it.

Reversal of Stock in Process Entry.

In order to record the opening value of material, labour and factory expense in process (at Standard) at the beginning of the new month, journal entry No. (7) must be reversed, viz.:—

(18)

Materials in Process	112 0 0	
Labour in Process	30 0 0	
Factory Expense in Process	40 0 0	
To Work in Process Clearing A/c.		182 0 0

(Being reversal of closing entry to record the opening work in process accounts at standard.)

It should be noted from the above accounts that the two fundamental variations from standard are:—

(a) Price variation, consisting of:—

1. Net variation between actual and standard price of materials used;
2. Net variation between actual and standard price of labour used;
3. Net variation between actual and budget factory expense for month.

(b) Quantity variation, consisting of:—

4. Net variation between actual and standard quantity of materials for the month's production, priced at standard.
5. Net variation between actual and standard quantity of labour for the month's production, priced at standard.
6. Net variation between budget hours of factory expense for month and actual for the month's production, priced at standard.
7. Net variation between actual hours of factory expense and standard hours for the month's production, priced at standard.

The principles involved in this method of cost accounting procedure relating to Ideal Standard Costs will also be found in the following example.

The White Company manufactures an article which passes through several processes. Ideal standards are in use and stocks are recorded in terms of standard. Separate Work in Process accounts are kept for Materials, Labour and Factory Expense.

The ideal standard unit cost for the completed product is:—

Materials—100 lbs. at 7½d. per lb.	£3	2	6
Labour—10 hours at 2/9 per hour	1	7	6
Factory Expense—2 machine hours at 22/6 per hour	2	5	0
	£6	15	0

The balances at the beginning of the month, which is the cost period, were:—

Raw Materials—40,000 lbs	1.240	0	0
Goods in Process—Materials—20,000 lbs. @ 7½d.	625	0	0
„ „ „ Labour—1,100 hours at 2/9	151	5	0
„ „ „ Factory Expense—210 hours @ 22/6	236	5	0
Finished Goods—260 units at £6/15/-	1,755	0	0

The costs of the period were:—

Materials purchases, as per invoices—94,000 lbs.	2,984	10	0
Labour, as per payroll summary—11,000 hours	1,567	10	0
Factory Supplies	522	10	0
General Factory Expense	405	0	0
Light	47	10	0
Heat	35	0	0
Power	496	15	0
Insurance—Fire	44	10	0
Insurance—Workers' Compensation	126	5	0
Repairs & Maintenance	115	0	0
Supervision	100	0	0
Depreciation—Plant & Machinery	406	15	0

Materials issues, as per Material Requisitions were:—

40,000 lbs.	£1,240	0	0
70,000 lbs.	2,222	10	0

The Labour was applied:—

10,000 hours to Goods in Process—Labour
1,000 „ to Repairs & Maintenance.

The Factory working time being normal, 2,000 machine hours were charged to Work in Process.

The closing stock of Work in Process included 10,000 lbs. of raw materials to which 400 hours of labour and 80 hours of machine time were applied.

Completed production totalled 1,100 units and 1,050 units were sold.

The various Journal Entries to record the foregoing would be :—

Raw Materials	Dr.		£1,240 0 0	
Goods in Process—Materials	„		625 0 0	
„ „ „ Labour	„		151 5 0	
„ „ „ Factory Expense ...	„		236 5 0	
Finished Goods	„		1,755 0 0	
To General Ledger Control A/c ...		Cr.		£4,007 10 0

(Being Opening Balances).

Raw Materials	Dr.		£2,984 10 0	
To General Ledger Control A/c.		Cr.		£2,984 10 0

(Being purchases made during the month.)

Labour A/c.	Dr.		£1,567 10 0	
To General Ledger Control A/c.		Cr.		£1,567 10 0

(Being amount of Payroll.)

Goods in Process—Labour	Dr.		£1,375 0 0	
Labour Rate Variance A/c.	„		50 0 0	
Repairs and Maintenance	„		142 10 0	
To Labour A/c.		Cr.		£1,567 10 0

(Being Labour distribution as per Payroll Summary.)

Factory Supplies...	Dr.		£522 10 0	
General Factory Expense	„		405 0 0	
Light	„		47 10 0	
Heat	„		35 0 0	
Power	„		496 15 0	
Insurance—Fire	„		44 10 0	
Insurance—Workers' Comp.	„		126 5 0	
Repairs & Maintenance...	„		115 0 0	
Supervision	„		100 0 0	
Depreciation	„		406 15 0	
To General Ledger Control A/c. ...		Cr.		£2,299 5 0

(Being Sundry Factory Expense Accounts.)

Goods in Process—Materials	Dr.		£3,437 10 0	
Material Price Variance A/c.	„		25 0 0	
To Raw Materials A/c.		Cr.		£3,462 10 0

(Being materials issued into production at standard, with price variance.)

Factory Expense Absorbed A/c. ...	Dr.		£2,441 15 0	
To Factory Supplies		Cr.		£522 10 0
Light		„		47 10 0
Heat		„		35 0 0
Power		„		496 15 0
Insurance—Fire		„		44 10 0
General Factory Expense ...		„		405 0 0
Insurance—Workers' Comp. ...		„		126 5 0
Repairs & Maintenance		„		257 10 0
Supervision		„		100 0 0
Depreciation—Plant & Equipment		„		406 15 0

(Being factory expenses incurred during period.)

Goods in Process—Factory Expense ...	Dr.		£2,250 0 0	
Factory Expense Price Variance A/c.	„		191 15 0	
To Factory Expense Absorbed A/c.		Cr.		£2,441 15 0

(Being Factory Expense Absorbed.)

Finished Goods A/c.	Dr.		£3,437 10 0	
Material Quantity Variance A/c. ...	„		312 10 0	
To Goods in Process—Materials ...		Cr.		£3,750 0 0

(Being transfer of Work in Process.)

Finished Goods A/c.	Dr.		£1,512 10 0	
To Goods in Process—Labour ...		Cr.		£1,471 5 0
Labour Efficiency Variance A/c.		„		41 5 0

(Being transfer of Work in Process.)

Finished Goods A/c.	Dr.		£2,475 0 0	
To Goods in Process—Factory Expense		Cr.		£2,396 5 0
Factory Expense Efficiency Variance A/c.		„		78 15 0

(Being transfer of Work in Process.)

Cost of Sales A/c.	Dr.		£7,087 10 0	
To Finished Goods A/c. ...		Cr.		£7,087 10 0

(Being 1,050 units sold at Standard Cost of £6 15 0 per unit.)

The various Ledger Accounts recording the above transactions would be:—

RAW MATERIALS A/c.

19—			19—		
Jan. 1	To Balance—40,000 lbs ...	1,240 0 0	Jan. 31	By Issues—40,000 lbs. ...	1,240 0 0
„ 31	„ Purchases—94,000 lbs. ...	2,984 10 0		„ Issues—70,000 lbs. ...	2,222 10 0
				„ Balance c/d....	762 0 0
		£4,224 10 0			£4,224 10 0
Feb. 1	To Balance b/d....	762 0 0			

GOODS IN PROCESS A/c.

MATERIALS.

Jan. 1	To Balance—20,000 lbs. @ 7½d.	625 0 0	Jan. 31	By Production—1,000 units ...	3,750 0 0
„ 31	„ Materials—110,000 lbs. @ 7½d.	3,437 10 0		„ Balance c/d ...	312 10 0
		£4,062 10 0			£4,062 10 0
Feb. 1	To Balance b/d....	312 10 0			

GOODS IN PROCESS A/c.

LABOUR.

Jan. 1	To Balance—1,100 hours @ 2/9 ...	151 5 0	Jan. 31	By Production—1,100 units ...	1,471 5 0
„ 31	„ 2,000 Machine Hours @ 22/6	1,375 0 0		„ Balance c/d....	55 0 0
		£1,526 5 0			£1,526 5 0
Feb. 1	To Balance b/d....	55 0 0			

GOODS IN PROCESS A/c.

FACTORY EXPENSE.

Jan. 1	To Balance—210 hours @ 22/6	236	5	0	Jan. 31	By Production—1,100 units ...	2,396	5	0
„ 31	„ 2,000 Machine Hours @ 22/6	2,250	0	0		„ Balance c/d. ...	90	0	0
		£2,486	5	0			£2,486	5	0
Feb. 1	To Balance b/d....	90	0	0					

FINISHED GOODS A/c.

Jan. 1	To Balance ...	1,755	0	0	Jan. 31	By Sales—1,050 units @ £6/15/- ...	7,087	10	0
„ 31	„ Production—1,100 units @ £3/2/6... ...	3,437	10	0		„ Balance c/d....	2,092	10	0
	„ Labour—1,100 units @ £1/7/6... ...	1,512	10	0					
	„ Factory Expense—1,100 units @ £2/5/-... ...	2,475	0	0					
		£9,180	0	0			£9,180	0	0
Feb. 1	To Balance b/d....	2,092	10	0					

GENERAL LEDGER CONTROL A/c.

Jan. 31	To Balance ...	10,858	15	0	Jan. 1	By Balance ...	4,007	10	0
					„ 31	„ Purchases ...	2,984	10	0
						„ Labour ...	1,567	10	0
						„ Fact. Ex. ...	2,299	5	0
		£10,858	15	0			£10,858	15	0
					Feb. 1	By Balance b/d....	10,858	15	0

LABOUR A/c.

Jan. 1	To Payroll—11,000 hours ...	1,567	10	0	Jan. 31	By Distribution ...	1,567	10	0

FACTORY SUPPLIES A/c.

Jan. 31	To supplies consumed	522	10	0	Jan. 31	By Fact. Ex. Absorbed... ...	522	10	0

LIGHT A/c.

Jan. 31	To Light consumed	47	10	0	Jan. 31	By Fact. Ex. Absorbed... ...	47	10	0

HEAT A/c.

Jan. 31	To Heat consumed	35	0	0	Jan. 31	By Fact. Ex. Absorbed... ...	35	0	0

POWER A/c.

Jan. 31	To Power consumed	496	15	0	Jan. 31	By Fact. Ex. Absorbed... ...	496	15	0

INSURANCE—FIRE A/c.

Jan. 31	To Charges accrued	44 10 0	Jan. 31	By Fact. Ex. Absorbed... ...	44 10 0

GENERAL FACTORY EXPENSE A/c.

Jan. 31	To Charges ...	405 0 0	Jan. 31	By Fact. Ex. Absorbed... ...	405 0 0

INSURANCE—WORKERS' COMPENSATION A/c.

Jan. 31	To charges accrued	126 5 0	Jan. 31	By Fact. Ex. Absorbed... ...	126 5 0

REPAIRS & MAINTENANCE A/c.

Jan. 31	To materials used	115 0 0	Jan. 31	By Fact. Ex. Absorbed... ...	257 10 0
	„ Labour used—1,000 hours ...	142 10 0			
		£257 10 0			£257 10 0

SUPERVISION A/c.

Jan. 31	To Charges ...	100 0 0	Jan. 31	By Fact. Ex. Absorbed... ...	100 0 0

DEPRECIATION—PLANT & EQUIPMENT A/c.

Jan. 31	To Reserve ...	406 15 0	Jan. 31	By Fact. Ex. Absorbed... ...	406 15 0

FACTORY EXPENSE ABSORBED A/c.

Jan. 31	To actual expenses incurred ...	2,441 15 0	Jan. 31	By Distribution ...	2,441 15 0

MATERIAL PRICE VARIANCE A/c.

Jan. 31	To Price Variance on Issues of 110,000 lbs. ...	25 0 0			

MATERIAL QUANTITY VARIANCE A/c.

Jan. 31	To Quantity Variance on Production of 1,100 units	312 10 0			

LABOUR RATE VARIANCE A/c.

Jan. 31	To Rate Variance on 10,000 hours	50 0 0			

LABOUR EFFICIENCY VARIANCE A/c.

			Jan. 31	By Efficiency Variation on production of 1,100 units	41 5 0

FACTORY EXPENSE PRICE VARIANCE A/c.

Jan. 31	To Price Variance on 2,000 Machine hours ...	191 15 0			

FACTORY EXPENSE EFFICIENCY VARIANCE A/c.

			Jan. 31	By efficiency variance on production of 1,100 units	78 15 0

COST OF SALES.

Jan. 31	To Cost of Sales—1,050 units ...	£7,087 10 0			

THE WHITE COMPANY.

PRELIMINARY TRIAL BALANCE—Jan. 31, 19....

Raw Materials	762 0 0	
Work in Process—Materials	312 10 0	
" " " Labour	55 0 0	
" " " Factory Expense	90 0 0	
Finished Stock	2,092 10 0	
General Ledger Control A/c.		10,858 15 0
Material Price Variance...	25 0 0	
Material Quantity Variance	312 10 0	
Labour Rate Variance	50 0 0	
Labour Efficiency Variance		41 5 0
Factory Expense Variance	191 15 0	
Factory Expense Efficiency Variance		78 15 0
Cost of Sales	7,087 10 0	
	£10,978 15 0	£10,978 15 0

Assuming sales for the period amounted to £10,000, an Income A/c can be prepared from the foregoing figures:—

INCOME A/c.

Sales		£10,000 0 0
Less Cost of Sales		£ 7,087 10 0
		£ 2,912 10 0
Add Variations (gains)—		
Labour Efficiency	£ 41 5 0	
Factory Expense Efficiency	£ 78 15 0	£ 120 0 0
		£ 3,032 10 0
Less Variations (losses)—		
Material Prices	£ 25 0 0	
Material Quantity	312 10 0	
Labour Rates	50 0 0	
Factory Expense Spending	191 15 0	£ 579 5 0
	Profit	£ 2,453 5 0

Variation ratios can then be developed as follows:—

FIGURE No. 79.

COMPARISON OF ACTUAL AND STANDARD PERFORMANCE.

For Month of January, 19.......

	Materials	% of Standard	Labour	% of Standard	Factory Expense	% of Standard
Standard Cost ...	3,437 10 0	100.0	1,512 10 0	100.0	2,475 0 0	100.0
Net Variances ...	337 10 0	9.8	8 15 0	.6	113 0 0	4.6
Actual Cost ...	£3,775 0 0	109.8	£1,521 5 0	100.6	£2,588 0 0	104.6
Variations by Causes—						
1. Price Variances	25 0 0	.7	50 0 0	3.3	191 15 0	7.7
2. Efficiency Variances ...	312 10 0	9.1	41 5 0*	2.7*	78 15 0*	3.1*
Net Variances ...	£337 10 0	9.8	8 15 0	.6	113 0 0	4.6

* Gain

CHAPTER 21.

IDEAL STANDARD COSTS.

COST ACCOUNTING PROCEDURE.

SECOND METHOD.

At the beginning of the last Chapter, reference was made to three methods of Standard Costs. It is now proposed to consider the second method, wherein Work in Process is both debited and credited with Standard Cost of production. The difference between this and the first method is that the latter debits Work in Process with Actual Cost and credits with Standard Cost.

For purposes of comparison, figures taken in this illustration are the same as those used in the previous Chapter.

1. Materials.

When invoices covering the purchase of materials are received, they obviously represent the actual quantity, calculated at the actual price. In order to give effect to this method of standard costs, it becomes necessary to calculate the standard price. This is readily obtained from the Standard Cost Card, and the figure desired is the actual quantity at standard price. The two sets of figures should now be available, viz., actual at actual, and actual at standard. Usually these particulars are entered in a Purchase Journal or Voucher Register specially ruled for the purpose (See Figure No. 80).

From these particulars, the amount over—or under—standard in relation to any invoice is readily available and at the end of the accounting period (weekly, monthly or any other period) the total variance in relation to all purchases can be calculated. In the example shown in Figure No. 80, the actual cost of all purchases is £223, and the standard cost of the purchases is £209, representing a difference of £14. Actually this is a price variance, and it is calculated at the time of entering the invoices. As the main feature of this method of standard costs is to carry the stocks at standard, the necessary entries should be such as to allow the standard figure of £209 to appear in the accounts and the £14 to be transferred outright to a Material Variation A/c.—Price.

FIGURE No. 80.
VOUCHER REGISTER.
(For Standard Costs).

Date	Voucher No.	Creditor	Materials	At Standard	Total Standard Cost	Actual Cost (as per Invoice)	Variation	Remarks
14/1/194	2461	John Jones Ltd.	A146. Fabric	1,200 yds. @ 2/-	£120 0 0	£126 5 0	£6 5 0	
15/1/194	2462	Martin & Smith	B220. Fabric	1,000 yds. @ 1/6	75 0 0	£ 73 10 0	*£1 10 0	
15/1/194	2463	L. L. Young Pty Ltd.	X30. Laces	560 yds. @ 6d.	14 0 0	£ 23 5 0	£9 5 0	English Lace purchased. Australian unobtainable.
					£209 0 0	£223 0 0	£14 0 0	

*Denotes actual less than standard.

In the illustration given in the previous Chapter, it will be remembered that there was an Opening Stock of £362/10/-, and it is assumed that in this case Standard and Actual are the same figure. The necessary Journal entry would therefore be:—

(1)

Raw Materials A/c.	362 10 0	
To General Ledger Control A/c.		362 10 0

(Being Opening Stock of Raw Materials priced at Standard.)

In accordance with the principle outlined above, the actual purchases amounting to £615/16/8 would have been analysed as these were entered in the Voucher Register or Purchase Journal, and would have been priced at Standard as well as at Actual. Assuming that there was only one purchase of each Raw Material, the entry in the Purchase Journal would appear as under:—

FIGURE No. 81.
PURCHASE JOURNAL.

Date	Particulars	Actual Price	Actual Total	Standard Price	Standard Total
Jan. 31	A.B. Company 1,000 pieces of " a "	5/3	262 10 0	5/-	250 0 0
„ „	C.D. Company 800 pieces of " b "	3/10	153 6 8	4/-	160 0 0
„ „	E.F. Company 2,000 pieces of " c "	2/-	200 0 0	2/-	200 0 0
			£615 16 8		£610 0 0

The net variation is, of course, £5/16/8, made up of an excess price of £12/10/- for "a," and a saving of £6/13/4 for "b."

As stocks are carried at standard, it is necessary to transfer this amount of £5/16/8 to a variation account, and the journal entry would be:—

(2)

Raw Materials A/c.	610 0 0	
Material Price Variation A/c.	5 16 8	
To General Ledger Control A/c.		615 16 8

(Being purchases of raw materials made during the month, at standard and transfer of material price variance.)

The main storekeeping factors under a standard cost system are similar to those under job order costs. With the former, however, there is an added control, inasmuch as a standard Bill of Materials will have been prepared and is available as a guide to the materials to be issued. Sometimes a copy of the standard bill of materials, divided appropriately, is used in place of material requisitions. Alternatively, the requisition on the store can list the various items, or those of them that are needed, as disclosed by the bill of materials. This is the authority for the storekeeper to issue the materials and it makes sure that the materials, as issued, are in accordance with the standards. Obviously, the standard may not always be attained and it may become necessary to obtain further materials. This is usually done by means of an excess materials requisition slip.

Where there is a tight control, a summary of the excess materials requisitions should show the excess material quantities used over standard.

The various requisitions are passed through the cost accounting department, where entries are made firstly in the Raw Materials Ledger accounts. These are usually kept in quantities only, because all such stocks are priced at standard, and there is therefore little need for the actual prices of materials to be included. The value of materials on hand is easily obtained by taking the quantity shown in the ledger and calculating this at the standard rate. This is one of the major benefits under this method of standard costs, inasmuch as the amount of clerical work may be greatly reduced.

Where the standard issues of materials are kept separately from excess issues, the standard value can be easily obtained by multiplying the standard quantities by the standard value. This is the figure which ultimately finds its way into the material in process account. The excess material requisition slips are also entered in the raw materials ledger accounts and are summarised in relation to quantities, calculated at standard rates, and form the basis for the entry for the amount to be transferred to Materials Quantity Variance A/c.

In the case of the illustration being taken, requisitions to cover standard quantities should have been received in respect of "a" 1,200 pieces, "b" 960 pieces, and "c" 1,800 pieces, and these should have been valued at the standard prices per piece, viz.:—

Standard pieces as per Bill of Materials:—

	"a"	"b"	"c"
In completed orders ...	1,000	800	1,500
In work in process ...	200	160	300
	1,200 @ 5/- £300	960 @ 4/- £192	1,800 @ 2/- £180

An analysis of excess or credit requisitions, however, discloses that 50 pieces of "a" have been requisitioned in addition to the standard quantity, whilst there has been a return of 20 pieces of "b." Actually, therefore, the material quantity variance would be represented by:—

"a"	Actual	1,250 pieces	Standard	1,200 pieces	Variance	50 pieces
"b"	„	940 „	„	960 „	„	20* „
"c"	„	1,800 „	„	1,800 „	„	Nil

* denotes standard less than actual.

Excess cost "a" 50 pieces @ 5/-	12	10	0
Lower cost "b" 20 „ „ 4/-	4	0	0
Net excess variance	£ 8	10	0

The journal entry to give effect to this would be:—

(3)

Materials in Process A/c....	672 0 0	
Materials Quantity Variation A/c.	8 10 0	
To Raw Materials A/c.		680 10 0

(Being standard quantity of materials, priced at standard, used in production as per requisition summary.)

It should be noted that in journal entries (2) and (3) the net variation has been shown in each case. If desired, the amount of variation affecting both debit and credit could be shown. With Journal Entry (2) the position would be:—

Raw Materials	610 0 0	
Material Price Variation	12 10 0	
To Material Price Variation		6 13 4
General Ledger Control A/c.		615 16 8

In the case of Journal entry (3) it would be :—

Materials in Process	672 0 0	
Materials Quantity Variation	12 10 0	
To Raw Materials		680 10 0
Materials Quantity Variation		4 0 0

This has the merit of showing the total excesses and the total savings, instead of the net figure. These figures can, however, be obtained in detail through the voucher register or purchase journal on the one hand and the materials requisition summary on the other.

Where excess materials requisition slips are in operation, the opportunity is usually taken to have these summarised according to the reasons necessitating the excess requirements. Thus, they can be sorted into spoilage, inferior material, excessive waste, etc.

2. Labour.

As in the case of materials, variations between the standard cost of labour and the actual cost are currently recorded. When work is to proceed and standard times have been set for the operation, the direct labour time card is frequently drawn to show the standard labour time allowed for the operation. The column representing the actual times taken is then filled in after the work has been completed. There are many advantages to be gained from the insertion of the standard time on the ticket itself. The workman knows what the standard is, knows what time he has to beat, and can, if he so desires, calculate his bonus where a bonus system is in operation. When the work has been completed, the time cards are routed through the timekeeper's office, and finally through to the cost accounting section, where the actual and standard rates will have been inserted.

The payroll summary form is also specially ruled to include particulars relating to both standard and actual, and as the various time cards are received, these particulars are inserted in the payroll summary. (See Figures 82 and 83).

FIGURE No. 82.
OPERATION TIME CARD.
(For Standard Costs.)

Name ....
Clock No. ....
Department..

Date.............................

Production Order No.	Drawing No.	Operation		Standard			Actual			Variation	
		No.	Details	Time Allowed	Rate	Amount	Time Taken	Rate	Amount	Hours	Amount

FIGURE No. 83.
PAYROLL SUMMARY.

Clock No.	Name	Dept.	Actual Amount		Total	Standard Amount	Variation	Deductions, Etc.
			Ordinary Time	Overtime				

From these particulars, the following figures could be obtained:—

1. Actual time at actual rate.
2. Actual time at standard rate.
3. Standard time at standard rate.

The first of these is the amount payable to the workman. The last is the amount which appears in the work in process account. The other is used to obtain the two types of variation—viz., price (or rate) and quantity (or efficiency).

In the illustration, the calculations mentioned above would be as under:—

(1)	1,000 hours at 3/-	£150 0 0	
	1,250 „ „ 2/10	177 1 8	
			£327 1 8
(2)	2,250 „ „ 3/-		337 10 0
(3)	2,200 „ „ 3/-		330 0 0

The price variation is the difference between (1) and (2), that is:—

337 10 0	
327 1 8	
	£10 8 4*

*denotes actual less than standard.

The quantity variation is the difference between (2) and (3)—

337 10 0	
330 0 0	
	£ 7 10 0

The journal entry necessary to give effect to the foregoing is:—

(4)

Labour in Process A/c.	330 0 0	
Labour Quantity Variation A/c.	7 10 0	
To Labour Price Variation A/c.		10 8 4
General Ledger Control A/c.		327 1 8
(Standard cost of labour used in production as per payroll summary.)		

3. Factory Expense.

There are three types of factory expense variation, viz.:—

Budget,
Idle Time,
Quantity.

Unlike material and labour, these variations can be ascertained only at the end of the period. The budget variation, for example, is obtained by comparing the total amount of factory expense incurred with the total amount appearing in the budget. This is sometimes referred to as a spending variation. The other two variances would be calculated in various ways according to the methods of application of factory expense. If, for example, this expense is spread on a machine hour rate basis, it would be necessary to know, firstly, the standard machine hours and the standard rates applicable thereto. This would mean that the various records would have to be set up to give this information. It may be done through the time cards or through Machine Logs. If expense is apportioned on a labour value basis, the necessary records would already be available through the payroll summaries, which, as stated above, give both the actual and the standard amounts. In the illustration being dealt with, Factory Expense is spread by a direct labour hour basis, and the payroll summary would therefore show, not only the standard wages and the actual wages, but also the standard and actual times. This information would be already available from the time cards, because it would have been available to calculate the standard and actual amounts of wages.

At the end of the period, therefore, an analysis of the difference between the standard hours and the actual hours would show the factory expense quantity variation. Thus, if 2,250 hours had been taken to do work which by standard basis should have been accomplished in 2,200 hours, there is an excess time of 50, and the factory expense applicable to these 50 hours is also an excess over standard. As against a standard basis there is nothing to show for this 50 hours, and there is also nothing to show for the factory expense applied to this 50 hours. The factory expense quantity variation would therefore be 50 hours at the standard rate of 4/-, which would equal £10.

When the standard rate for factory expense was being worked out prior to the beginning of the period, it had been calculated that there should be 2,400 direct labour hours of work produced. Actually, there were only 2,250 direct labour hours of work carried out, and of this, 50 hours represented a factory expense quantity variation. This has already been taken into account as a variation, however, so that as 2,400 hours should have been worked and only 2,250 hours were actually worked, 150 hours were lost, presumably through idle time. The value of this idle time, calculated at standard rate, would be 150 hours at 4/-, viz., £30.

The necessary journal entry to give effect to the foregoing would be:—

(5)

Factory Expense in Process A/c.	440	0	0			
Factory Expense Idle Time Variation A/c.	30	0	0			
Factory Expense Quantity Variation A/c.	10	0	0			
To Factory Expense Budget Variation A/c.				5	0	0
General Ledger Control A/c.				475	0	0

(Being standard amount of factory expense charged into production with expense variations as above.)

The other journal entries would be:—

(6)

Finished Goods A/c.	1,260	0	0			
To Material in Process A/c.				560	0	0
Labour in Process A/c.				300	0	0
Factory Expense in Process A/c.				400	0	0

(Being standard cost of goods completed during the month as per finished goods summary, viz.:—

	Units	Per Unit	Amount	
Materials	100	5 12 0	560 0 0	
Labour	100	3 0 0	300 0 0	
Expense	100	4 0 0	400 0 0	
				£1,260 0 0.)

(7)

Cost of Sales A/c.	1,134	0	0			
To Finished Goods A/c.				1,134	0	0

(Being cost of finished products sold during the period as under—90 units at standard cost of £12 12 0.)

(8)

General Ledger Control A/c.	1,620	0	0			
To Sales A/c.				1,620	0	0

(Being 90 units sold at £18 per unit.)

(9)

Selling Expenses A/c.	150 0 0	
General Expenses A/c.	100 0 0	
To General Ledger Control A/c.		250 0 0

(Being selling and general expenses incurred.)

The General Ledger Control A/c has again been used as a type of Balance A/c.

The following ledger accounts would be raised from the foregoing journal entries:—

RAW MATERIALS A/c.

Jan. 1	To Opening Stock (1)	362 10 0	Jan. 31	By Materials issued (3)	680 10 0
„ 31	„ Purchases (2) ...	610 0 0		„ Balance c/d ...	292 0 0
		£972 10 0			£972 10 0
Feb. 1	To Balance b/d. ...	292 0 0			

MATERIALS IN PROCESS A/c.

Jan. 31	To Material Issues (3)	672 0 0	Jan. 31	By Finished Goods (6)	560 0 0
				„ Balance c/d. ...	112 0 0
		£672 0 0			£672 0 0
Feb. 1	To Balance b/d. ...	112 0 0			

LABOUR IN PROCESS A/c.

Jan. 31	To Payroll Summary (4) ...	330 0 0	Jan. 31	By Finished Goods (6)	300 0 0
				„ Balance c/d. ...	30 0 0
		£330 0 0			£330 0 0
Feb. 1	To Balance b/d. ...	30 0 0			

FACTORY EXPENSE IN PROCESS A/c.

Jan. 31	To Expense Summary (5) ...	440 0 0	Jan. 31	By Finished Goods (6)	400 0 0
				„ Balance c/d. ...	40 0 0
		£440 0 0			£440 0 0
Feb. 1	To Balance b/d. ...	40 0 0			

FINISHED GOODS A/c.

Jan. 31	To Work in Process (6)	1,260 0 0	Jan. 31	By Sales (7) ...	1,134 0 0
				„ Balance c/d. ...	126 0 0
		£1,260 0 0			£1,260 0 0
Feb. 1	To Balance b/d. ...	126 0 0			

COST OF SALES A/c.

Jan. 31	To Sales (7) ...	1,134 0 0			

SALES A/c.

			Jan. 31	By Sundry Drs. (8)	1,620 0 0

SELLING EXPENSE A/c.

Jan. 31	To Sundries (9) ...	150 0 0			

GENERAL EXPENSE A/c.

Jan. 31 To Sundries (9) ... 100 0 0

GENERAL LEDGER CONTROL A/c.

Jan. 31	To Sales (8) ...	1,620	0	0	Jan. 31	By Opening Stock (1)	362	10	0
	„ Balance b/d. ...	410	8	4		„ Purchases (2) ...	615	16	8
						„ Labour—Payroll (4)	327	1	8
						„ Factory Expense (5)	475	0	0
						„ Selling Expense (9)	150	0	0
						„ General Expense (9)	100	0	0
		2,030	8	4			2,030	8	4
					Feb. 1	By Balance b/d. ...	410	8	4

MATERIAL PRICE VARIATION A/c.

Jan. 31 To Price Variations (2) 5 16 8

MATERIAL QUANTITY VARIATION A/c.

Jan. 31 To Sundries (3) ... 8 10 0

LABOUR QUANTITY VARIATION A/c.

Jan. 31 To Sundries (4) ... 7 10 0

LABOUR PRICE VARIATION A/c.

Jan. 31 By Sundries (4) ... 10 8 4

FACTORY EXPENSE IDLE TIME VARIATION A/c.

Jan. 31 To Sundries (5) ... 30 0 0

FACTORY EXPENSE QUANTITY VARIATION A/c.

Jan. 31 To Sundries (5) ... 10 0 0

FACTORY EXPENSE BUDGET VARIATION A/c.

Jan. 31 By Sundries (5) ... 5 0 0

The foregoing ledger accounts would show the following balances:—

Account	Debit	Credit
Raw Materials...	292 0 0	
Materials in Process ...	112 0 0	
Labour in Process	30 0 0	
Factory Expense in Process	40 0 0	
Finished Goods	126 0 0	
Cost of Sales ...	1,134 0 0	
Sales		1,620 0 0
Selling Expense	150 0 0	
General Expense	100 0 0	
General Ledger Control A/c.		410 8 4
Material Price Variation A/c.	5 16 8	
Material Quantity Variation A/c. ...	8 10 0	
Labour Quantity Variation A/c. ...	7 10 0	
Labour Price Variation A/c.		10 8 4
Factory Expense Idle Time Variation A/c.	30 0 0	
Factory Expense Quantity Variation A/c.	10 0 0	
Factory Expense Budget Variation A/c....		5 0 0
	£2,045 16 8	£2,045 16 8

The following income statement could be prepared from the above figures:—

Sales				1,620	0	0
Less Cost of Sales				,134	0	0
Gross Profit at Standard				486	0	0
Less Selling Expense	150	0	0			
General Expenses	100	0	0			
				250	0	0
Net Profit at Standard				236	0	0

(This assumes Selling and General Expense at Standard with no variations.)

Add Variation A/cs. (Gains)—						
Labour Price Variation	10	8	4			
Factory Expenses Budget Variation	5	0	0			
				15	8	4
				251	8	4
Less Variation A/cs. (Losses)—						
Material Price Variation A/c.	5	16	8			
Material Quantity Variation A/c.	8	10	0			
Labour Quantity Variation A/c.	7	10	0			
Factory Expenses Idle Time Variation A/c.	30	0	0			
Factory Expenses Quantity Variation	10	0	0			
				61	16	8
Net Profit—Actual				£189	11	8

CHAPTER 22.

IDEAL STANDARD COSTS.

TREATMENT OF STOCKS AND VARIATIONS.

Comparison of First and Second Methods.

The two methods of Ideal Standard Costs outlined in the preceding chapters do not vary to any great degree. By a comparison of the figures, it will be found that in the first method, the gross profit, after adjustment of variations, is £441/11/8, while the various stocks amount to £602/-/-. In the case of the second method, the profit is £439/11/8, and the stocks are £600/-/-. The difference of £2/-/- between the two methods is to be found in the valuation of the raw material, which in the first method is kept at actual, and in the second is adjusted from actual to standard.

This latter factor is the key to the difference between the two methods, inasmuch as in the latter, wherever possible, variances including the adjustment of raw material prices are taken up progressively. In the first method, the variations are taken up at the end of the period, and price adjustments in respect of raw materials are not made until these are charged into production.

Apart from raw materials, all work in process and finished stock accounts are kept at standard.

Both methods can use the same type of cost, viz., an ideal cost representing some desirable performance, an expected actual or some such standard.

Furthermore, the same variances are calculated, viz., price and efficiency variations relating to materials, labour and expense.

The first method is usually used for simple businesses where no great degree of analysis is required. The number of departments may be few or may be limited to one. Furthermore, there may be only a single product made, or perhaps very few. Under these circumstances, the possible complications arising from the keeping of actual figures as debits and standards as credits, may be kept to a minimum, and the first method may give all the detail required in relation to variations together with fundamental causes of such.

As a rule the second method is used where the business is much more complex, where detailed analyses of operations are available, and where if need be the different variations can be exhibited in relation to operations, so that detailed analyses in relation to causes and functional responsibility become possible. The second method is much more commonly used, largely because those organisations which take up standard costs have usually prepared the ground by complex organisational procedure covering all phases of production control, and thus operational costs are available. The variations in relation to these operational costs set the seal on efficiencies available through the use of standards.

The First Method.

Especially when dealing with the first method, care should be exercised in arriving at the value of stocks. In the case of raw materials, the usual method is to count the stock, where its size and complexity allow this to be done. As with job order systems, the book figure is sometimes taken for purposes of the accounts, though it is advisable to check figures with actual stocktaking periodically. The same pricing procedure as operates in job order costs can be used and the raw materials can be charged into production under any of the accepted methods, such as first-in first-out, average, etc.

In the case of work in process, a physical inventory is usually carried out. This is done by inspecting the work and noting the last operation completed. The cost would then be calculated as in the following example:—
Assume Labour Costs as under:—

Operation No. 1	2/-
„ „ 2	1/-
„ „ 3	2/-
„ „ 4	3/-
„ „ 5	3/-
„ „ 6	2/-

The physical survey shows that 200 units have been completed to Operation No. 3, 100 to Operation No. 5, and 400 to Operation No. 1. The labour cost would therefore be:—

400 to Operation 1—400 @ 2/-	£40	0	0
200 „ „ 3—200 @ 5/-	50	0	0
100 „ „ 5—100 @ 11/-	55	0	0
	£145	0	0

Where factory expense is apportioned on a Direct Labour Hour basis, the method of calculating factory expense in work in process would be the same. Assume the following factors:—

Operation No. 1	1 hour
„ „ 2	½ „
„ „ 3	1 „
„ „ 4	1½ „
„ „ 5	1½ „
„ „ 6	1 „

Factory expense is apportioned at the rate of 2/6 per hour. The amount involved would be:—

400 to Operation 1—400 @ 1 „	400 hours	
200 „ „ 3—200 @ 2½ hours	500 „	
100 „ „ 5—100 @ 5½ „	550 „	
	1,450 hours @ 2/6—	£181 5 0

Finished stock could be taken by physical count, and presents no problem in pricing as the standard cost would be used.

The Second Method.

It has already been pointed out that the second method can be used even though there are great complexities of costs. As it deals essentially with operational costs, it can be used in relation to many types of industry where the operations are complicated. The raw material may, for example, pass through a large number of departments, where the operations may be many. Different products may come from the initial raw material, and widen out to a large variety of finished products emerging from the last department. The production control system may be in operation in such a way as to provide for specific orders which can be traced throughout the plant, each one retaining its identity. On the other hand, production orders may be of a repetitive type, where it is impossible to keep separate the various orders. The former of these two corresponds more to the job order system, and printing orders are examples of specific orders which can be treated under standard costs. The latter—repetitive—are of a process nature, as, for example, the manufacture of cement. There are also combinations of the two methods, inasmuch as it may be possible to identify the product operating under a specific production order up to a certain stage in the plant, but after that stage its identity may be lost, because one production order merges into another.

The degree of detail which can be handled through a standard cost system is surprising. In a textile mill, for example, it is possible through the standard cost system to obtain such factors as the following:—

1. The material price variances in the raw material.
2. Material quantity variances in the knitting department, such variances being shown in relation to each type of yarn and each product manufactured.
3. The labour inefficiency in the knitting department, such inefficiency being traceable to operations and if need be to foreman and operatives. The information can also be shown divided into the causes for inefficiency.
4. The variations in labour rates or allowances in relation to the knitting department.
5. The idle time which has occurred and a statement of the reasons for such.
6. The spending variation in relation to the department, with a statement as to which amounts have been under or over spent.
7. The price variation of the finished fabric delivered from the knitting department.
8. The material quantity variances of the cutting department, and the reasons for such. This information can be supplied in relation to operators, foremen, types and numbers of fabric and products upon which the fabric is used.
9. The amount of spoilage for which the cutting department is responsible.
10. The labour inefficiency in the cutting department exhibited in relation to foremen and operatives, but also in connection with product classes and styles.
11. The variations in labour rates or allowances in relation to the cutting department.
12. The idle time which has occurred in the cutting department and the reasons for such.
13. The spending variation in relation to the cutting department, with a statement as to which amounts have been under or over spent.

Similar information could be supplied in relation to the machining department, finishing department, packing and warehousing departments.

Variations between standard and actual costs can be shown in relation to mills, warehouses, departments, products, styles and, if need be, sizes. Obviously, the amount of clerical effort necessary to exhibit the whole of this information would be great, but the operation of standard costs does facilitate keeping clerical effort at a minimum. The reason for this is that the fundamental basis of standard costs is the principle of exceptions. The variations are disclosed, and it is the variations which are important. This is one of the main factors in the value of standard cost accounting to management, which is becoming increasingly exception-minded as the years go by.

Consolidated Stock Accounts.

In the illustrations given in the previous chapters, the various stock accounts were shown as comprising raw materials, work in process materials, labour and factory expense, and finished goods. Where it is practicable to do so, it is possible to combine these various stocks in a Total Stock A/c. To the debit of this account would be posted all stocks on hand, including raw materials, work in process and finished stock, at the beginning of the period, together with all purchases during the period. The account would be credited with all material quantity variations, and with all goods sold, calculated at standard cost. The variations would be covered in the usual way, and the balance of the account would represent raw materials, work in process and finished stock. The individual items would be controlled through the subsidiary ledger accounts. The advantage of this method is to be found in the elimination of transfers from raw materials to work in process, and labour and factory expense to work in process, and from work in process to finished stock. The method does eliminate some clerical work, but great care should be exercised in arriving at any decision to adopt one stock account, as a great deal of confusion may arise. Certain types of organisation do, however, lend themselves to this method of treatment, because of the simplified nature of their stock transactions. The difficulty of locating discrepancies is one of the major disadvantages of this method of treating stocks.

Factory expense accounts can also be shortened by:—

1. (a) charging the expense account with actual direct expense,
   (b) charging the various departments for services received at standard rates,
   (c) crediting the departments with the amounts applied to the production of the departments.
2. (a) charging the departmental accounts in the subsidiary expense ledgers with actual direct expense as incurred,
   (b) debiting the factory expense control a/c in total,
   (c) at the end of the period charging the inventories account with the standard expense applicable to the completed operations.

Here again care must be exercised in arriving at any decision to shortcut procedure.

VARIATIONS.

Standard cost systems are designed to disclose variations, and these can be primarily divided into two types:—

1. Price variations, consisting of:—
    - (a) the difference between actual and standard price of materials used.
    - (b) the difference between actual and standard rates of labour used.
    - (c) the difference between the actual and the budgeted factory expense for the period.
2. Quantity variations consisting of:—
    - (a) the difference between the actual and standard quantities of materials used in production, valued at standard,
    - (b) the difference between the actual and standard amount of labour used in production, valued at standard,
    - (c) the difference between the actual and budgeted hours of factory expense for the period, valued at standard,
    - (d) the difference between the actual hours of factory expense and the standard hours for the month's production, valued at standard.

Any consideration of variations is usually made in relation to the specific element of cost, viz., material, labour or expense. These are considered hereunder:—

1. Material Price Variations.

Consideration has already been given to the practice involved in the setting of standard prices for materials entering into production. The differences between the actual prices and the standard fixed may be due to a number of causes, as, for example:—

(a) Changes in price.
(b) Purchase in small or large quantities resulting in higher prices or quantity discounts.
(c) Changes in handling expenses debited to the products.

Usually variances of this type are the responsibility of the purchasing department, though sometimes financial considerations may enter into the matter. It is usual to ask the purchasing agent to analyse the differences and to submit a statement showing the causes.

2. Material Quantity Variations.

These may be due to a number of factors, such as:—

(a) Waste, through carelessnesses or other causes.
(b) Defective materials.
(c) Rejects upon inspection.
(d) Obsolescent materials.
(e) Pilferage.
(f) Shortage of materials, involving substitution.
(g) Poor production methods.
(h) Unskilled employees.

Where a Bill of Materials is used as the authority for the storekeeper to supply the standard materials required, or where standard requisitions are prepared from the Bill of Materials, excess materials requisition slips may facilitate a speedy analysis into causes. A summary should be prepared showing, where necessary, materials affected, departments, foremen or operators involved, and causes of the excesses. If this information becomes available speedily, it enables the works manager or the foreman to give prompt attention to the matter, and so eliminate the trouble. The analysis of materials quantity variations can be of the greatest assistance in their elimination.

3. Labour Rate Variations.

The standard rates applicable to any operation should be carefully calculated, but it is only to be expected that there will be some variations. These may be occasioned by:—

1. Changes in rates, as for example, basic wage changes.
2. Wrong type of workmen carrying out the job, as for example, a leading hand may carry out work set for an ordinary operator.
3. Seniors may carry out work designed for juniors or apprentices.

It is not always possible, of course, to see that the grade or type of workmen originally planned for the work when the standards were calculated actually carries it out. Furthermore, periodical adjustments in the basic wage may cause discrepancies. In certain cases, juniors are planned for work, but, particularly in wartime, the number of juniors available may be fewer than is required. On the other hand, a foreman may be careless in such matters, and may make it a practice to employ the wrong type of employee on a job. Any weaknesses of this nature will be disclosed through the variations, and the matter of correction can be promptly applied.

4. Labour Quantity Variations.

This variation is usually the best guide to labour efficiency. Frequently the standard time appears on the time card when this is handed to the operator. When it is handed back, the actual time is entered and there is therefore an immediate comparison between actual and standard times. Any vigilant foreman can inquire on the spot into any marked or sustained discrepancies. Usually the time cards clerk segregates the time cards showing any difference between standard and actual times which the foreman should know about. Such discrepancies are not always the fault of the operator. It is true they may be caused through:—

(a) Poor quality workmen.
(b) Poorly trained workmen.
(c) Dissatisfied workmen.
(d) Workmen who have received incorrect instructions.

They may, however, also be caused through:—

(a) Defective materials.
(b) Waiting for materials.
(c) Defective or worn-out machinery.
(d) Use of incorrect equipment.
(e) Poor working conditions, particularly in relation to heating, lighting and ventilation.
(f) Incompetent supervision.
(g) Incorrect shop and production orders.
(h) Faulty routing of work through the plant.
(i) Training new operators.
(j) Failure of power.
(k) Lack of sales orders.

Whilst every endeavour should be made to check the troubles at the sources, with a wide variety of possible causes, it is essential that the variations be listed in terms of causes. Some of the reasons enumerated above can be responsible for the loss of large sums of money, and frequently analysis of labour quantity variations is the first step towards a greater efficiency.

5. Factory Expense Budget Variations.

The factory expense rates are the result firstly of a complete budget of factory expense relating to the business as a whole, or departmentalised where necessary, together with the number of direct labour hours or other divisor nominated as the basis of apportionment. The budget variation represents the difference between the amount of the budgeted expense and the actual expense incurred. It is really a spending variation. This variance must be considered in conjunction with the other two variances associated with factory expense. It is possible that an over-expenditure as against the budget, may still be a satisfactory result. On the other hand, if actual factory expense shows excessive spending as against the budget, the variances can be shown in relation to the various expense accounts and from these the responsibility in terms of personnel can be judged. Whilst factory expense budgets are usually prepared in terms of departments, they can also be compiled in relation to cost centres or foremen. The cost centre facilitates a further sub-division of functional responsibility, whilst if budgets are prepared in terms of foremen it is possible to supply them with weekly operating results, which will not only show labour efficiency, but will also indicate to them any excesses or gains in relation to those expenses over which they have control.

6. Factory Expense Idle Time Variation.

This variation is related somewhat to the labour quantity variation, and the same cause that promotes the variance in the latter may be responsible for that in the former. The reason for idle time may primarily be the responsibility of (a) the sales department for not providing enough orders, (b) the repairs and maintenance department for not keeping machines in proper repair, (c) the planning office because of bad planning or faulty instructions, (d) the shop transportation section for bad handling and routing of work, (e) the purchasing department for faulty deliveries, (f) the storekeeping department for defective materials, or (g) the powerhouse for failure of power. It will be seen that this variation should be examined in conjunction with the labour quantity variation.

7. Factory Expense Quantity Variations.

Factors affecting this variance may be similar to those outlined in connection with idle time. Where factory expense is spread on machine hours, it is advisable to have idle machine reports and here again causes are the important factor.

8. Other Variations.

Whilst the foregoing deals with the main variations, the calculation of detailed variations is also possible. Thus some of the variations are capable of being analysed into the amount of variances due to specific causes. One of the most common is the amount due to calendar variations. If, for example, a factory supervisor received a salary of £50 per month, and the standard working hours in a working month were 200, a variation would occur if in one month, such as February, he worked only 180 hours. 200 hours for a salary of £50 represents an hourly rate of 5/-, and for 180 hours the amount applicable would be only £45, showing a variance of £5. This is, of course, outside the control of the supervisor but it should be adjusted over the year if the number of standard hours has been correctly ascertained for that period.

Similarly, if, instead of working 180 hours, the plant worked only 160 hours because of a power break-down, a further variation of £5 would occur due to this cause.

Thus, if the standard hourly production was 100 pieces, in 180 hours the production would be 18,000 pieces. If the production was only 15,000 pieces, the variation would be £7/10/-, of which £5 would be due to the power break-down and £2/10/- to a failure to realize standard production.

CHANGING STANDARDS.

1. Substitution of Other Materials.

It is not always possible to obtain the exact materials specified in the standard cost card and taken into account in calculating the standard cost. Some provision must therefore be made for the procedure to be adopted in the event of a substitution of materials becoming necessary. Usually this is effected by provision of a materials substitution form, which is the authority for changing over from the standard originally prescribed. The form must be signed by a responsible official, and it should show, firstly, the quantity and standard value of the original material, secondly, the quantity and standard value of the substitute material and thirdly, the difference in the standard values, thus:—

Original —50 yards @ 2/-	£5	0	0
Substitute—50 „ „ 2/6	6	5	0
Difference in Standard Values	£1	5	0

These material substitution forms are summarised and recorded periodically. The total is journalised as under:—

Materials in Process	5	0	0			
Substitution Materials Variation...	1	5	0			
To Raw Materials				6	5	0

2. Scrap Materials.

When work is scrapped under a standard cost system, the procedure is as follows:—

It is assumed that the part spoiled shows the following progressive cost:—

Materials—2 yards @ 5/-		10	0
Labour—Operation 1—2 hours @ 4/-			
2—4 „ „ 5/-...	1	8	0
Factory Expense—6 hours at 10/-	3	0	0
	£4	18	0

The spoiled unit is scrapped and a scrap value of £1 is placed upon it. The journal entries would be:—

Spoiled Work Variation	4 18 0	
To Work in Process		4 18 0
(Being value of work taken out of production.)		

Spoiled Work Stock	1 0 0	
Department A Factory Expense...	3 18 0	
To Spoiled Work Variation		4 18 0
(Being adjustment of spoiled work variation.)		

Depending upon the circumstances, the amount of £3/18/- in the above journal entry may be written off direct to Profit and Loss A/c or may be allowed to remain in the Spoiled Work Variation A/c, until subsequently written off to P. & L. A/c.

3. Alteration of Standards.

Usually an attempt is made to carry standards unchanged throughout the accounting or costing period. At times, however, it does become necessary to make a change, and consideration must be given to the method to be adopted to give effect to such change in the cost accounting records.

The standard cost of product "A" has in the past been:—

Materials	£5 0 0
Labour	4 0 0
Factory Expense	6 0 0
Total	£15 0 0

A new standard has to be entirely re-calculated and this is finally decided as being:—

Materials	£6 0 0
Labour	5 0 0
Factory Expense	7 10 0
Total	£18 10 0

During the period 10 units are produced, the actual expense involved being:—

Materials	64 0 0
Labour	52 0 0
Factory Expense	74 0 0
Total	£190 0 0

Work in Process A/cs. would be charged according to the new standard cost rates:—

Work in Process	185 0 0	
Labour Variation	2 0 0	
Material Variation	4 0 0	
To Materials		64 0 0
Labour		52 0 0
Factory Expense		74 0 0
Factory Expense Variation		1 0 0
(Being work in Process charged at new standard cost.)		

The balance due to the change in the standards could be deducted from Work in Process (if desired) by the following entry:—

Standard Change Variation A/c.	35 0 0	
To Work in Process A/c.		35 0 0
(Being difference between new and old standards, viz.— £18 10 0, Less £15 0 0, i.e. £3 10 0 each for 10 units.)		

DISPOSITION OF VARIATIONS.

Where variations have been entered in the books of account, the question of their disposal must be faced at the end of the accounting period. There is much difference of opinion as to the manner in which this should be effected.

Under both the first and second methods of Ideal Standard Costs, work in process and finished stocks are carried at standard. In the case of the second method, which is much the more common one, raw materials are also carried at standard. The controversy therefore centres around the question as to whether stocks should be carried at standard and the final accounts for the period prepared on this basis. There are really three groups of opinions in this connection:—

Firstly, those who believe that there should be no interference with the standards.

Secondly, those who are of the opinion that actual costs should be used.

Thirdly, those who compromise somewhat by suggesting that material price variations insofar as these affect raw materials on hand should be written back into stocks of raw materials.

The opinions upon which these groups base their contentions are examined below:—

1. The Use of Standards.

The first group is of the opinion that all variances appearing in the accounts for the period should be written off during that period. Usually this means writing the variances off to Profit and Loss A/c as under:—

Profit & Loss A/c.	Dr.	
To Material Price Variation A/c.		Cr.
Material Quantity Variation A/c.		,,
Labour Price Variation A/c.		,,
Labour Quantity Variation A/c.		,,
Factory Expense Budget Variation A/c.		,,
Factory Expense Idle Time Variation A/c.		,,
Factory Expense Quantity Variation A/c.		,,

The advocates of this plan base their contention upon the following factors:—

1. Losses due to inefficiency, waste, extravagance and inactivity should not be allowed to be included as part of product costs, but should be written off in a manner similar to other losses. There is no contention that these do not represent costs, but rather that they are costs which should not be allowed to be included in the valuation of the stocks.
2. These variations represent manufacturing losses which should be written off when incurred, and not when the goods are sold. They should not be temporarily capitalised and appear in the company's balance sheet.

3. If the standards are set carefully and with due regard to the importance of accuracy, they are suitable and valuable for the measurement of efficiency and accomplishment and they should therefore be adequate for the valuation of stocks.
4. The use of standards is responsible for considerable savings in clerical work. There is also a considerable advantage in added simplicity, together with the facilitation of earlier operating statements.
5. Losses due to idle capacity are almost invariably written off and the same treatment should be extended to other variations, which, it is claimed, do not vary greatly in principle.

2. The Use of Actuals.

Those who object to the use of standards in the accounts maintain that the actual figures should be used in the valuation of stocks. They contend:—

1. The final accounting statements should show the truth, and only actual figures can represent the truth. This is the end of the period view, and is particularly held by many accountants and auditors as opposed to cost accountants.
2. Requirements of Taxation Acts are simplified by the use of actual costs. The use of standards may necessitate adjustments, firstly, to preserve continuity of the method of statement of accounts, and to avoid adjustments necessary to see that excess tax is not paid.
3. Fluctuations in standards can be very confusing, and the whole aspect of standard costs, together with the amount of variations which would be shown, is dependent entirely upon the bases which have been used for the preparation of the standards. There is no agreement amongst those who advocate the use of standards for stock valuations regarding the fundamental approach to the preparation of standards. Without such an agreement, the variations shown may represent differences resulting from the use of standards which may in one case represent an easily reached task and in another a particularly difficult one.
4. Variations are not always losses, and gains can be and are in fact made. If there are credit variances in relation to material and labour prices, the question arises as to whether these should be treated as profits. This may have the effect of over-stating the profit (which would thus be available for distribution) and it is contended that this attacks the fundamental principle, long established, of the valuation of stocks at cost or market, whichever is the lower.

3. The Adoption of Compromise.

It must be admitted that the arguments of both sides have strength, and it is impossible to lay down rules which must be followed in every case. This has given rise to a group which seeks to compromise between the two sets of opinions. This group sets out with the assumption that there are some losses which both groups would be prepared to recognise. Idle capacity for example, would usually be written off, irrespective of whether stocks were carried at standards or actuals. On the other hand, material price variations insofar as they affect raw materials still on hand, represent the weakest argument in favour of the use of standards. This group is usually in favour of adjusting the standard raw materials prices by the amount of the materials price variation applicable thereto and writing off all other losses during the period. Even in the latter matter, however, inquiry would be directed towards any special factors which should be taken into account and which may call for an adjustment of stocks.

ALTERNATIVE COST ACCOUNTING TREATMENTS.

The following entries set forth the various cost accounting entries to cover the various methods of treating Variation Accounts.

1. Closing All Variations to Profit and Loss A/c.

This would be effected by the following entry:—

Profit & Loss A/c. Dr.
To Material Price Variation A/c. Cr.
Material Quantity Variation A/c. „
Labour Price Variation A/c. „
Labour Quantity Variation A/c. „
Factory Expense Budget Variation A/c. „
Factory Expense Idle Time Variation A/c. „
Factory Expense Quantity Variation A/c. „

There may, however, be some credit balances in variation accounts, in which case these would be written off to the credit of Profit and Loss A/c., viz.:—

Profit & Loss A/c. Dr.
Material Price Variation A/c. „
Labour Price Variation A/c. „
To Profit & Loss A/c. Cr.
Material Quantity Variation A/c. „
Labour Quantity Variation A/c. „
Factory Expense Budget VariationA/c. „
Factory Expense Idle Time Variation A/c. „
Factory Expense Quantity Variation A/c. „

2. Closing Some Variations to Profit and Loss A/c.

(a) The debit balances in the variations may be transferred to Profit and Loss A/c., and the credit balances transferred to a Stock Adjustment A/c. and held in reserve. The entry would be:—

Profit & Loss A/c. Dr.
To Material Quantity Variation A/c. Cr.
Labour Quantity Variation A/c. „
Factory Expense Budget Variation A/c. „
Factory Expense Idle Time Variation A/c. „
Factory Expense Quantity Variation A/c. „

Material Price Variation A/c. Dr.
Labour Price Variation A/c. „
To Stock Adjustment A/c. Cr.

(b) All variations can be written off to Profit and Loss A/c., with the exception of the Material Price variance. That proportion of this variance applicable to raw materials can be transferred to raw materials.

To effect this, it is necessary to ascertain a ratio between standard and actual and to apply this to the raw materials on hand. Thus, if it was found that actual cost of materials during the period was 102% of the standard, and the amount of raw materials at standard was £10,000, the amount of the raw materials stock would be increased to £10,200. This would be effected by a journal entry:—

Raw Materials Stock	Dr.	200 0 0	
Profit & Loss A/c. (Say)		100 0 0	
To Material Price Variation A/c.			300 0 0

This would mean that the balance in the Materials Price Variation A/c. would cover a variation belonging to work in process, finished goods on hand and finished goods manufactured and sold during the period. The balance written off to Profit and Loss A/c. would represent the amount of Material Price Variation applicable to Work in Process, Finished Stock and Cost of Sales. If the ratio above referred to was less than 100, the entry would be reversed.

(c) The same principle can be adopted to adjust both work in process and finished stock.

Again it would be necessary to use a cost ratio, and the journal entry would be:—

Raw Materials Stock A/c.	Dr.	
Work in Process A/c.	"	
Finished Goods A/c.	"	
Profit & Loss A/c.	"	
To Material Price Variation A/c.		Cr.

The amount written off to Profit and Loss A/c. would represent that portion of Material Price Variation applicable to Cost of Sales.

3. Closing Only Idle Time to Profit and Loss A/c.

It may be desired to show cost of sales at actual costs. This could be effected by taking the three elements of materials, labour and expense and applying the various ratios to the variation accounts. If, for example, Factory Expense Idle Time was £500, Other Factory Expense Variations were £140, Materials Variations were £100, and Labour Variations were £150, with a Standard Cost of Sales £15,000, the latter figure could be adjusted to Actual by use of Material, Labour and Expense cost ratios, thus:—

Cost Sales A/c.	275 0 0	
To Materials Variations A/c.—		
1.1% of £5,000		55 0 0
Labour Variation A/c.—		
2% of £6,000		120 0 0
Factory Expense Variation A/c.— (Not Idle Time)		
2½% of £4,000		100 0 0

It will be seen that the total of the Cost of Sales A/c. was made up of:—

Standard Materials	£5,000 0 0
Standard Labour	£6,000 0 0
Standard Factory Expense	£4,000 0 0

The Factory Expense Variation due to idle time would be written off to Profit and Loss A/c., and not pro-rated to Cost of Sales, because the other variations presumably covered factors for which the factory was responsible, whereas this would probably not be the case with Idle Time.

If this adjustment was not made, the amount debited to Profit & Loss would be:—

Profit & Loss A/c. Dr.	15,890 0 0	
To Cost of Sales A/c.		15,000 0 0
Factory Expense Idle Time A/c.		500 0 0
Materials Variation A/c.		100 0 0
Labour Variation A/c.		150 0 0
Factory Expense Variation A/c.		140 0 0

When the proportionate amount has been transferred to Cost of Sales, the position would be:—

Profit & Loss A/c.	15,775 0 0	
To Cost of Sales A/c.		15,275 0 0
Factory Expense Idle Time A/c.		500 0 0

The difference between the first Profit and Loss debit of £15,890/-/-, and the second of £15,775/-/- would be the amount applicable to raw materials, work in process and finished stock manufactured during the period.

The proportionate variations due to each of these accounts could be adjusted by journal entry as explained previously. When making adjustments of this type it is necessary to watch the effect of Opening Stocks, which would play no part in the variations.

EFFECT OF ADOPTION OF STANDARDS.

Before proceeding to an attempt to sum up the opinions expressed in favour or against the use of standards, the effect upon profits under varying circumstances from the use of standards as against actuals should be noted.

Differences During One Accounting Period.

In Chapters 20 and 21 an illustration was used to show two different methods of keeping Standard Costs. If those figures are analysed, it will be found that a Trading A/c. prepared at actual figures would give the following result:—

Sales	£1,620 0 0
Less Cost of Sales	1,169 9 9
Gross Profit	£450 10 3

The stocks on hand calculated at actual would be:—

Raw Materials	294 0 0
Work in Process	186 19 5
Finished Goods	129 19 1
Total	£610 18 6

Under the first method of Ideal Standard Costs, the position would be:—

Sales	1,620 0 0
Less Cost of Sales	1,134 0 0
Gross Profit	£ 486 0 0
Add Variations Gains	15 8 4
	£ 501 8 4
Less Variations—Losses	59 16 8
Gross Profit	£ 441 11 8

The value of stocks under this method would be:—

Raw Materials	294	0	0	
Work in Process	112	0	0	(Materials)
" " "	30	0	0	(Labour)
" " "	40	0	0	(Expense)
Finished Goods	126	0	0	
Total	£602	0	0	

Under the second method of Ideal Standard Costs, the following position would be disclosed:—

Sales	1,620	0	0
Less Cost of Sales	1,134	0	0
	486	0	0
Add Variations—Gains	15	8	4
	501	8	4
Less Variations—Losses	61	16	8
Gross Profit	£439	11	8

The value of stocks under this method would be:—

Raw Materials	292	0	0	
Work in Process	112	0	0	(Materials)
" " "	30	0	0	(Labour)
" " "	40	0	0	(Expense;
Finished Goods	126	0	0	
Total	£600	0	0	

It should be remembered that whilst this would be the position in this accounting period, it does not always follow that the standard net profit would be lower than the actual net profit. As the stocks at the close of the period would be priced lower, in the next period when they are sold, the profit would be higher. In other words, it should be remembered that the difference between the use of standard costs and actual costs does not mean a loss of profit but rather it spreads the profit differently between accounting periods.

Over the total life of a business, the profits under standard costs and actual costs should be the same, but they would vary from year to year. The difference between standard and actual profit in any period is represented by the difference between the standard cost and the actual cost of stocks at the beginning and the end of the financial period. The reason for this is that the variations in cost of finished stock, sold in the period it is manufactured, would have no effect because such variations are written off either to Profit and Loss or as part of the cost of sales.

From the foregoing it can be followed that if there are no stocks at either the beginning or the end of a period, the manufacturing profit will be the same under standard or actual costs, because again all variations will appear either in the cost of sales or the profit and loss account.

If there are stocks at the end of the period, but none at the beginning, the difference between standard and actual results will be equal to the amount of the variation applicable to the stocks on hand at the end of the period.

In a case where the variation in stocks at the beginning and end of the period is exactly the same, the profit result will be the same, though it does not follow that the valuation of stocks would be the same under the actual method as the standard. Other combinations can be worked out from these factors. For example, if the variation on the opening stock is greater than on the closing stock, the standard profit is larger if the variation is a loss, and smaller if the variation is a gain. If the variation in closing stocks is greater, the position is reversed.

CONCLUSION.

It is not possible to arrive at a judgment which can be applied to all cases. There is no doubt that standard cost accounting has very great benefits to bestow, and has not only come to stay, but will probably become more popular in the future. There is also much to be said for the contention that waste and inefficiency should be excluded from product costs. On the other hand, one cannot lose sight of the fact that the value to be placed upon final statements prepared in terms of standards depends entirely upon the accuracy of those standards. If the standards have been carelessly set, the adoption of these for purposes of completing the final statements loses all value, and may promote positive harm. If, for example, standards were set very low, and gainful variations were therefore high, misleading results may be shown by the adoption of the standard cost in closing stocks. A result may be disclosed which certainly does not accord with the true state of affairs. The profit may be increased to show an incorrect result for that period, and the increase would probably have to be paid for in future periods. Similarly, mistakes do occur in the setting of standards and whilst the result may not be serious, an erroneous impression may be given.

This is a matter which must be settled in relation to the individual circumstances operating within each organisation. With most cost accountants, there is a preference towards the use of standards, the writing off of variations where these represent losses, the transfer of variations representing profits to stock reserves and the adjustment of any serious discrepancies in relation to standards or material price variances. With most auditors there is still a preference towards the completion of final statements based on actual costs.

CHAPTER 23.

BASIC STANDARD COSTS.

COST ACCOUNTING PROCEDURE.

One of the major criticisms levelled against Standard Costs is that stocks of works in process and finished goods (and in certain cases raw materials) are carried at standard costs, and not at actuals. The implications and arguments, both in favour and against were considered in more detail in Chapter No. 22, but it is necessary to state at this juncture that the third method of standard costs is designed to reap at least some of the advantages accruing from a study of variations from standards, and yet allow stocks to be carried in the financial books at actuals.

This method is usually referred to as Basic Standard Costs, because it usually adopts costs more in the nature of index figures than ideal standards. It should be noted, however, that it is possible to use ideal standards with this method of standard cost accounting.

Dual Recording.

The fundamental difference between this method and the two previously considered, is that the accounting system is designed to show both standards and actuals, and for this purpose dual records are kept. In many cases, only the standard costs need be recorded in detailed form, because the actual figures are arrived at by means of the use of ratios. Usually each ledger account has two debit and two credit columns, representing standard and actual debits and standard and actual credits.

Whilst dual columns are used, only the actual columns are used in the final financial accounting, though it may be necessary to use the standard to arrive at the actual.

There are, at times, some variations of this procedure, inasmuch as in certain specialised cases, even three columns may be used on each side, viz., standard, actual and variance. Even with a dual system, there may be a large amount of detailed accounting involved, and in certain original records both standard and actual figures must be calculated. Sometimes, therefore, an attempt is made to limit the work, by dispensing with the standard columns in the ledger accounts, and all calculations in relation to standard costs, together with those necessary to arrive at actual costs, are done in memoranda form only. The usual practice is, however, to have the dual system.

Methods of Approach.

In order to arrive at the various figures, two methods may be adopted:

1. The inclusion of standard costs on production orders only.

   Under this method, standard costs are first determined, and are then inserted in columns provided in all production orders. As production proceeds, actual costs are recorded, and from the two sets of figures, variances are calculated. This method is frequently used where it is desired to treat the standard costs in memoranda form.

2. The inclusion of standards in all journal and ledger accounts.

Both journals and ledgers would have two debit and two credit columns, though as mentioned above, this is sometimes varied to provide three debit and three credit columns in the journal (so as to exhibit the variances) and two debit and two credit columns in the ledger accounts. In a system of basic standard costs, comparisons between standard and actual performance are shown by means of cost ratios, which are expressed in the form of percentages. These represent units of measurement only, and frequently do not represent measures of efficiency. As stated previously, they are really index numbers and a comparison can be made with the cost of living index. If this latter index was 100 in 1914 and 140 in 1935, 142 in 1936, 144 in 1937 and 141 in 1938, a comparison of the various figures would show the trend. It would be evident that 1938 showed the lowest figure since 1935, and it would also be known that the index figure for 1938 was considerably higher than 1914. In the case of cost ratios associated with basic standard costs, the cost of raw material "a" might be standardized at 100 for 1935. The standard might be preserved for the next five years and during that period the actual cost ratio might be 103 in 1936, 107 in 1937, 109 in 1938 and 105 in 1939. It would be apparent that the general trend had been upward since 1935, that it had dropped in 1939, but that it was still considerably above 1935. It would not be known, however, whether a cost ratio of 105 in 1939 as against 100 in 1935 represented a satisfactory measure of accomplishment. One of the advantages usually argued in favour of basic standards is that there is no need to vary the standard, unless some fundamental change occurs. Nevertheless, with many executives, something is definitely lost if the standard does not represent some target or ideal to be reached. It must always be clearly recognised, therefore, that usually under basic standard costs, the cost ratio may not signify what has been accomplished in terms of the ideal.

In order that the method of operating cost ratios should be clearly understood, a simple example covering materials, labour and manufacturing expense is set out hereunder, and from the figures given the various cost ratios will be calculated.

Calculation of Ratios.

The following information is available in respect of a business which has adopted Basic Standard Costs, and the various cost ratios are desired:—

Materials—	
(a) Actual Cost of Materials consumed	£5,000
(b) Standard Cost of Materials, specified for actual production reached ...	£4,800
(c) Standard Cost of Materials consumed...	£5,100
Labour—	
(a) Actual Direct Labour Cost—24,000 hours at 4/2 per hour	£5,000
(b) Standard Direct Labour cost for actual production reached—22,000 hours at 4/- per hour	£4,400
Factory Expense—	
(a) Actual factory expense incurred during the period...	£6,500
(b) Standard factory expense on budgeted production for the period—28,000 direct labour hours @ 5/- per hour	£7,000

Factory expense is applied to production on the basis of Direct Labour Hours.

The foregoing figures would yield the following cost ratios:—

1. Materials Ratios.

(a) Material Cost Ratio—

$$\frac{\text{Actual Cost of Material consumed}}{\text{Standard Cost of materials specified for actual production}} \quad \frac{\text{£5,000}}{\text{£4,800}} \text{—} 104.166$$

The actual material cost was therefore 104.166% of the standard materials specified for the production actually reached.

(b) Material Price Ratio—

$$\frac{\text{Actual Price of Material consumed}}{\text{Standard Cost of Material consumed}} \quad \frac{5{,}000}{5{,}100} \text{—} 98.039$$

The actual material price was therefore 98.039% of the standard price set for those materials.

(c) Material Quantity Ratio—

$$\frac{\text{Standard Cost of Material consumed}}{\text{Standard Cost of Materials specified for actual production}} \quad \frac{5{,}100}{4{,}800} \text{—} 106.25$$

The actual material quantities were therefore 106.25% of the standard quantities set.

This ratio may also be expressed as follows:—

$$\frac{\text{Material Cost Ratio}}{\text{Material Price Ratio}} \text{ — } \frac{104.166}{98.039} \text{ — } 106.25$$

2. Labour Ratios.

(a) Labour Cost Ratio—

$$\frac{\text{Actual Direct Labour Cost}}{\text{Standard Direct Labour Cost for Actual production reached}} \text{ — } \frac{5{,}000}{4{,}400} \text{ — } 113.636$$

Actual labour cost was therefore 13.636% above the standard labour cost for that production.

(b) Labour Efficiency Ratio—

$$\frac{\text{Standard Direct Labour Hours specified for actual production reached}}{\text{Actual Direct Labour Hours}} \text{ — } \frac{22{,}000}{24{,}000}$$

$$\text{——} \; 91.666$$

Actual Labour was therefore only 91.666% effective, or expressing this in another way, the number of Direct Labour Hours used was $\frac{100}{91.666}$ —109.07% of standard.

(c) Wage Level Ratio—

$$\frac{\text{Actual Rate Paid per Direct Labour Hour}}{\text{Standard Rate specified per Direct Labour Hour}} \text{ — } \frac{4/2}{4/\text{–}} \text{ — } 104.166$$

The wage level was therefore 4.166% above the standard allowed.

This ratio could also have been calculated from the ratios previously calculated, as follows:—

Wage level ratio—

$$\frac{\text{Labour Cost Ratio}}{\text{Ratio of Direct Labour Hours used to Standard}} \text{ — } \frac{113.636}{109.09} \text{ — } 104.166$$

3. Manufacturing Expense Ratios.

(a) Manufacturing Expense Cost Ratio—

$$\frac{\text{Actual Manufacturing expense incurred during period}\quad 6,500}{\text{Standard Manufacturing expense on budgeted production for that period}\quad 7,000} = 92.857$$

Actual manufacturing expense was therefore 92.857% of the standard manufacturing expense on the budgeted production for the period.

(b) Manufacturing expense idle capacity ratio—

$$\frac{\text{Actual Direct Labour Hours}}{\text{Budgeted Direct Labour Hours}} = \frac{24,000}{28,000} = 85.714$$

Actual Direct Labour Hours used was therefore 85.714% of Direct Labour budgeted, or this factor could alternatively be expressed by saying that idle capacity was 14.286%.

(c) Manufacturing Expense Expenditure Ratio—

$$\frac{\text{Actual Manufacturing Expense incurred during the period}}{\text{Actual Direct Labour Hours used}} = \frac{£6,500}{24,000} = 108.32$$

$$\text{Divided by} \qquad\qquad \text{divided by}$$

$$\text{Standard manufacturing expense rate per Direct Labour Hours} \qquad 5/-$$

The actual manufacturing expense expenditure per direct labour hour was therefore 108.32% of standard.

This ratio may also be calculated as under:—

(d) Manufacturing Expense Production or Labour Efficiency Ratio—

$$\frac{\text{Manufacturing Expense Cost Ratio}}{\text{Manufacturing Expense Idle Capacity Ratio}} = \frac{92.857}{85.714} = 108.333$$

The Labour Ratio Efficiency has already been determined in the labour ratios, viz.:—91.666, that is, the ratio between the standard direct labour hours specified for production and the actual direct labour hours used. In the example taken, it has been mentioned that manufacturing expense is applied on the basis of actual direct labour hours used, and therefore this ratio is not taken into consideration. Where manufacturing expense is applied on the basis of production or on standard direct labour hours for that production (as, for example, where standard costs are charged in the ledger to work in process a/cs.) the manufacturing expense cost ratio would be affected by the production efficiency ratio.

The foregoing illustrations show how the various cost ratios are calculated, and the principles underlying these calculations are used in the conversion of standard figures to actuals in the various ledger accounts. In dealing with Ideal Standards the methods were illustrated by the use of one set of transactions. These figures are again used for the purpose of showing how they would operate under a system of Basic Standard Costs. In addition, Selling and General Expenses are included. In the first place the journal entries will be given for both the standard and actual figures, but the method of arriving at some of the figures appearing in the journal entries will only be clearly seen by referring to the ledger accounts, where an explanation of the method of arriving at the relevant cost ratio is given. In this example, the Standard figures represent Actual at Standard. The same results would be obtained if the figures were Standard at Standard as the efficiency ratio is 100 throughout.

Example.

The following would be the relevant journal entries:—

	Standard Dr.	Standard Cr.	Actual Dr.	Actual Cr.
(1)				
Raw Materials A/c.	362 10 0		362 10 0	
To Gen. Ledger Control A/c.		362 10 0		362 10 0
(Being opening stock of raw materials.)				
(2)				
Raw Materials A/c.	610 0 0		615 16 8	
To Gen. Ledger Control A/c.		610 0 0		615 16 8
(Being purchases of raw material made during the period.)				
(3)				
Materials in Process A/c. ...	672 0 0		676 0 8	
To Raw Materials A/c. ...		672 0 0		676 0 8
(Being materials used in production as per requisition summary at standard price.)				
(4)				
Labour in Process A/c.... ...	330 0 0		327 1 8	
To Gen. Ledger Control A/c.		330 0 0		327 1 8
(Being labour used in production as per payroll summary at standard rate.)				
(5)				
Factory Expense in Process ...	440 0 0		475 0 0	
To Gen. Ledger Control A/c.		440 0 0		475 0 0
(Being amount of factory expense charged into production at standard rate.)				
(6)				
Finished Stock A/c.	1,260 0 0		1,292 10 6	
To Materials in Process ...		560 0 0		563 7 2
Labour in Process ...		300 0 0		297 6 11
Fact. Ex. in Process ...		400 0 0		431 16 5
(Being cost of goods completed during the month as per finished stock summary.)				
(7)				
Cost of Sales	1,134 0 0		1,163 5 2	
To Finished Stock A/c. ...		1,134 0 0		1,163 5 2
(Being cost of finished product sold during the period.)				
(8)				
Gen. Ledger Control A/c. ...			1,620 0 0	
To Sales A/c....				1,620 0 0
(Being sales made during the period.)				
(9)				
Selling Expense A/c.			150 0 0	
General Expenses A/c.... ...			100 0 0	
To Gen. Ledger Control A/c.				250 0 0
(Being selling and general expenses incurred.)				

In the above journal entries the credit to Standard in entries (1), (2),

(4) and (5) has been shown as General Ledger Control A/c. Frequently these postings would not be made to General Ledger Control A/c., but to a Standard Clearing A/c. This would largely depend upon the degree to which the standards were taken in the books of account.

The foregoing journal entries would be posted in the ledger accounts as under:—

RAW MATERIALS A/c.

	Standard	Actual		Standard	Actual
To Opening Stock	362 10 0	362 10 0	By Issues to process	672 0 0	676 0 8
Purchases	610 0 0	615 16 8	Balance c/d.	300 10 0	302 6 0
	£972 10 0	£978 6 8		£972 10 0	£978 6 8
To Balance b/d.	£300 10 0	£302 6 0			

Price Ratio—£978 6 8 divided by £972 10 0 — 100.6.
Actual Issues to Work in Process—£672 times 100.6—£676 0 8.

MATERIALS IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Raw Materials	672 0 0	676 0 8	By Finished Stock	560 0 0	563 7 2
			Balance c/d.	112 0 0	112 13 6
	£672 0 0	£676 0 8		£672 0 0	£676 0 8
To Balance	112 0 0	112 13 6			

Price Ratio—£676 0 8 divided by £672 0 0--100.6.
Efficiency Ratio—£672 0 0 divided by £672 0 0—100.
Actual Cost of transferred Finished Stock—£560 times 100.6—£563 7 2.

LABOUR IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Payroll ...	330 0 0	327 1 8	By Finished Stock	300 0 0	297 6 11
			Balance c/d.	30 0 0	29 14 9
	£330 0 0	£327 1 8		£330 0 0	£327 1 8
To Balance b/d.	30 0 0	29 14 9.			

Price Ratio—£327 1 8 divided by £330 0 0—99.116.
Efficiency Ratio—£330 0 0 divided by £330 0 0—100.
Actual Cost of Transferred Finished Stock—£300 times 99.116—£297 6 11.

FACTORY EXPENSE IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Expense Summary	440 0 0	475 0 0	By Finished Stock	400 0 0	431 16 5
			Balance c/d.	40 0 0	43 3 7
	£440 0 0	£475 0 0		£440 0 0	£475 0 0
To Balance b/d.	40 0 0	43 3 7			

Price Ratio—£475 0 0 divided by £440 0 0—107.955.
Efficiency Ratio—£440 0 0 divided by £440 0 0—100.
Actual Cost of Transferred Finished Stock—£400 times 107.955—£431 16 5.

FINISHED STOCK A/c.

	Standard	Actual		Standard	Actual
To Mat. in Process	560 0 0	563 7 2	By Sales ...	1,134 0 0	1,163 5 2
Lab. „ „	300 0 0	297 6 11	Balance c/d.	126 0 0	129 5 4
Fact. Ex. „	400 0 0	431 16 5			
	£1,260 0 0	£1,292 10 6		£1,260 0 0	£1,292 10 6
To Balance b/d.	126 0 0	129 5 4			

Price Ratio—£1,292 10 6 divided by £1,260 0 0—102.58.
Efficiency Ratio—£1,260 0 0 divided by £1,260 0 0—100.
Actual Cost of Finished Stock transferred—£1,134 0 0 times 102.58—£1,163 5 2.

COST OF SALES A/c.

	Standard	Actual		Standard	Actual
To Sales	£1,134 0 0	£1,163 5 2			

SALES A/c.

	Standard	Actual		Standard	Actual
			By Sales		1,620 0 0

GENERAL LEDGER CONTROL A/c.

	Standard	Actual		Standard	Actual
To Sales		1,620 0 0	By Opening Stock		362 10 0
Balance c/d.		410 8 4	Purchases		615 16 8
			Payroll		327 1 8
			Factory Ex.		475 0 0
			Selling Ex.		150 0 0
			General Ex.		100 0 0
		£2,030 8 4			£2,030 8 4
			By Balance b/d.		£410 8 4

SELLING EXPENSE A/c.

	Standard	Actual		Standard	Actual
To Sundries		150 0 0			

GENERAL EXPENSES A/c.

	Standard	Actual		Standard	Actual
To Sundries		£100 0 0			

TRIAL BALANCE.

	Standard Dr.	Actual Dr.	Standard Cr.	Actual Cr.
Raw Materials	300 10 0	302 6 0		
Materials in Process	112 0 0	112 13 6		
Labour in Process	30 0 0	29 14 9		
Factory Expense in Process	40 0 0	43 3 7		
Finished Stock	126 0 0	129 5 4		
Cost of Sales	1,134 0 0	1,163 5 2		
	1,742 10 0	1,780 8 4		
Sales				1,620 0 0
General Ledger Control A/c.				410 8 4
Selling Expense		150 0 0		
General Expenses		100 0 0		
		£2,030 8 4		£2,030 8 4

An income statement could be prepared from the foregoing figures:—

INCOME STATEMENT.

		Standard	Actual
Sales		1,620 0 0	1,620 0 0
Less Cost of Sales		1,134 0 0	1,163 5 2
		486 0 0	456 14 10
Less Selling Expenses	150 0 0		
General Expenses	100 0 0	250 0 0	250 0 0
Net Profit		£236 0 0	£206 14 10
Variation	£29 5 2		

An analysis of the variation shown (£29/5/2) could be made as follows:—

ANALYSIS OF VARIATIONS.

	Finished Stock Charged to Cost of Sales at Standard	Cost Ratio to bring to Actual	Finished Stock Charged to Cost of Sales At Actual	Variance
Material...	504 0 0	100.6	507 0 6	3 0 6
Labour	270 0 0	99.116	267 12 3	2 7 9*
Factory Expense	360 0 0	107.95	388 12 5	28 12 5
	£1,134 0 0		£1,163 5 2	29 5 2

Net Variance £29 5 2 as per Cost of Sales.

*denotes actual less than standard.

The amount of £1,134/-/- is made up from the original Standard Costs of the product in relation to each element, viz.:—

Material—90 units @ £5/12/-	£504 0 0
Labour 90 „ „ £3/-/-	270 0 0
Factory Expense—90 units @ £4	360 0 0
	£1,134 0 0

The Total Variance in the Finished Stock A/c. is £32/10/6, made up of:

Net Variance as per Cost of Sales	29 5 2	
Net Variance of Finished Stock on Hand	3 5 4	(Actual £129 5 4 Standard £126 0 0.)
	£32 10 6	

In the foregoing illustration, only a price ratio has been shown, as the efficiency ratio is in every case 100. This is occasioned by the fact that there are no variations between the values of actual and standard stocks.

In order to show the two variations, the figures shown for Stocks on Hand can be altered to show the following balances:—

Raw Materials, previously £300 10 0, now £280 0 0.
Materials in Process, previously £112 0 0, now £100 0 0.
Labour in Process, previously £30 0 0, now £20 0 0.
Factory Expense in Process, previously £40 0 0, now £30 0 0.
Finished Stock, previously £126 0 0, now £100 0 0.

Differences of this kind may be occasioned by spoilages, pilferage, short receipt of goods, etc. The shortages in the work in process and finished stocks could be caused similarly. Thus, when a physical stocktaking of raw materials is made, the stock calculated at standard may come to only £280, instead of £300/10/-.

The effect of these shortages can be traced through the following accounts:—

RAW MATERIALS A/c.

	Standard	Actual		Standard	Actual
To Opening Stock	362 10 0	362 10 0	By Issues to Work in Process	672 0 0	676 0 8
Purchases	610 0 0	615 16 8	Balance c/d.	280 0 0	281 13 6
Shortage (Cr.)	20 10 0	20 12 6			
	£952 0 0	£957 14 2		£952 0 0	£957 14 2.
To Balance b/d.	£280 0 0	£281 13 6			

Price Ratio=£978 6 8 divided by £972 10 0=100.6.
Actual Issues to Work in Process is therefore calculated:—
£672 0 0 × 100.6 = £676 0 8.
Shortage=£20 10 0 × 100.6 = £20 12 6.

It should be noted that in this example, the shortage is shown as a credit entry on the debit side. No efficiency ratio is calculated because the issues to work in process a/c. would be either at (1) standard, in which efficiency would be 100; or (2) actual, in which case the efficiency ratio would manifest itself in the Materials in Process A/c.

MATERIALS IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Raw Materials	372 0 0	676 0 8	By Finished Goods	560 0 0	573 12 2
Shortage—Cr. (Spoilage)	12 0 0	(no entry)	Balance c/d.	100 0 0	102 8 6
	£660 0 0	£676 0 8		£660 0 0	£676 0 8
To Balance b/d.	£100 0 0	£102 8 6			

Overall Ratio = £676 0 8 divided by £660 0 0 = 102.43.
Price Ratio = £676 0 8 divided by £672 0 0 = 100.6.

$$\textit{Efficiency Ratio} = \frac{\text{Overall Ratio}}{\text{Price Ratio}} = \frac{102.43}{100{\cdot}6} = 101.82.$$

Actual Cost of Transferred Stock is:—

$$£560 \times \left(\frac{100.6 \times 101.82}{102.43}\right) = £573\ 12\ 2.$$

LABOUR IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Payroll	330 0 0	327 1 8	By Finished Goods	300 0 0	306 12 6
„ Shortage (Cr.)	10 0 0	(no entry)	Balance c/d.	20 0 0	20 9 2
	£320 0 0	£327 1 8		£320 0 0	£327 1 8
To Balance b/d.	£20 0 0	£20 9 2			

$$\textit{Overall Ratio} = \frac{£327\ 1\ 8}{£320\ 0\ 0} = 102.21.$$

$$\textit{Price Ratio} = \frac{£327\ 1\ 8}{£330\ 0\ 0} = 99.116.$$

(Assuming Standard at Standard, whilst Actual at Standard would include other variations except spoilage and the price and efficiency variations as disclosed.)

$$\textit{Efficiency Ratio} = \frac{\textit{Overall Ratio}}{\textit{Price Ratio}} = 103.12.$$

$$\textit{Actual Cost of Transferred Stock} = £300 \times \left(\frac{102.21}{99.116 \times 103.12}\right) = £306\ 12\ 6$$

The debit in the Standard column should be Standard @ Standard (£320/-/-) for operations completed. This would indicate that there was no time variation on good production. By treating the shortage as a credit entry in the Standard column, both price and efficiency ratios can be calculated as above, without the necessity for further data. Again the spoilage is prorated over both Finished Goods and Work in Process.

It will be remembered that the original journal entry for materials entering into production was:—

	Standard	Actual	Standard	Actual
Materials in Process A/c.... ...	672 0 0	676 0 8		
To Raw Materials A/c. ...			672 0 0	676 0 8
(Being materials used in production as per requisition summary at Standard price.)				

This standard entry indicates actual quantities at standard price. As the actual entry shows actual quantities at actual price, the difference, £4/0/8, must represent a price variance. Of this price variance, 560/660ths would appear in the transfer to Finished Goods, and 100/660ths would remain in Materials in Process. These two amounts would be £3/8/4 and 12/4, respectively. Efficiency variances may be due to several causes. In this case, it is justifiable to assume that, except for the spoilage, the actual quantities issued into production are the same as standard quantities. The efficiency variance, therefore, resolves itself into the calculation of the ratio due to spoilage. Of the £12/-/-, 560/660ths (£10/3/10) is applicable to Finished Goods and 100/660ths (£1/16/2) to Work in Process. Thus the total variance transferred to Finished Goods is £3/8/4 plus £10/3/10, i.e., £13/12/2. The amount of variance remaining in the Work in Process A/c. is 12/4 plus £1/16/2, i.e., £2/8/6.

It should be noted that there is no credit entry shown on the debit side of the Actual column. The adjustment here is automatic through the application of the two ratios. Any extra entry would have the effect of inflating the amounts. Turning back to the Raw Materials A/c., it will be noted that there was a credit entry in the debit Actual column. This represented a shortage, and the deduction had to be made to adjust the stock on hand. If this was not inserted, the stock would be inflated. The difference between this account and the Materials in Process A/c. is to be found in the fact that in the former, the standard amount of £20/10/-, represents a shortage which must be written out of the stock balances. In the latter case, it is a spoilage which increases the actual cost and therefore remains in the accounts, being divided between Finished Goods and Work in Process A/c.

FACTORY EXPENSE IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Expense Summary	440 0 0	475 0 0	By Finished Goods	400 0 0	441 17 3
Spoilage (Cr.)	10 0 0	(no entry)	Balance c/d	30 0 0	33 2 9
	£430 0 0	£475 0 0		£430 0 0	£475 0 0
To Balance b/d.	£30 0 0	£33 2 9			

$$\textit{Overall Ratio} = \frac{£475\ 0\ 0}{£430\ 0\ 0} = 110.465.$$

$$\textit{Price Ratio} = \frac{£475\ 0\ 0}{£440\ 0\ 0} = 107.955.$$

$$\textit{Efficiency Ratio} = \frac{\text{Overall Ratio}}{\text{Price Ratio}} = \frac{110.465}{107.955} = 102.325.$$

Actual Cost of Transferred Stock = £400 × 110.465 = £441 17 3.

Here again the spoilage has been prorated over Finished Goods and Work in Process.

FINISHED GOODS A/c.

	Standard	Actual		Standard	Actual
To Material in Process	560 0 0	573 12 2	By Sales	1,134 0 0	1,189 17 8
„ Labour in Process	300 0 0	306 12 6	„ Balance c/d.	100 0 0	104 18 7
„ Factory Expense in Process	400 0 0	441 17 3			
	1,260 0 0	1,322 1 11			
„ Shortage Cr.	26 0 0	27 5 8			
	£1,234 0 0	£1,294 16 3		£1,234 0 0	£1,294 16 3
To Balance b/d.	£100 0 0	£104 18 7			

$$\textit{Price Variation} = \frac{\text{£1,322 1 11}}{\text{£1,260 0 0}} = 104.928.$$

Shortage—£26 0 0 × 104.928 = £27 5 8.
Sales—£1,134 0 0 × 104.928 = £1,189 17 8.

The shortage would be debited to Profit and Loss A/c. or Cost of Sales, depending upon policy. Only the price ratio is required as the debits are standards for each element.

ANALYSIS OF VARIATIONS IN FINISHED GOODS.

	Standard	Actual		Variations	Total
Material	560 0 0	573 12 2	Price	3 8 4	
			Efficiency	10 3 10	
					13 12 2
Labour	300 0 0	306 12 6	Price	2 14 9*	
			Efficiency	9 7 3	
					6 12 6
Factory Expense	400 0 0	441 17 3	Price	32 11 2	
			Efficiency	9 6 1	
					41 17 3
	£1,260 0 0	£1,322 1 11			£62 1 11
	62 1 11				
	£1,322 1 11				

The calculations to arrive at the above variations would be:—

Materials—			
Price	—Actual @ Actual	£573 12 2	
	Actual @ Standard (£560 0 0 × 101.82) ...	570 3 10	
			£ 3 8 4
Efficiency	—Actual @ Standard	£570 3 10	
	Standard @ Standard	560 0 0	
			£10 3 10
Labour—			
Price	—Actual @ Actual	£306 12 6	
	Actual @ Standard (£300 0 0 × 103.12) ...	309 7 3	
			£ 2 14 9*
Efficiency	—Actual @ Standard	£309 7 3	
	Standard @ Standard	300 0 0	
			£ 9 7 3
Factory Expense—			
Price	—Actual @ Actual	£441 17 3	
	Actual @ Standard (£440 0 0 × 102.325)...	409 6 1	
			£32 11 2
Efficiency	—Actual @ Standard	£409 6 1	
	Standard @ Standard	400 0 0	
			£ 9 6 1
			£62 1 11

These calculations refer only to Work in Process A/cs., insofar as transfers are made to Finished Goods A/c.

CHAPTER 24.

BASIC STANDARD COSTS.

TREATMENT OF STOCKS AND VARIATIONS.

Having explained the principles underlying the calculation of the various cost ratios in connection with ledger accounts, the following example, whilst more complicated, should illustrate the use of Basic Standard Costs in connection with the normal transactions in a factory.

The Allen Manufacturing Company uses a Basic Standard Cost System, and the opening balances are as follows :—

	DEBITS		CREDITS	
	Standard	Actual	Standard	Actual
General Ledger Control A/c.				11,350 0 0
Raw Materials " a "	3,000 0 0	3,250 0 0		
" " " b "	1,750 0 0	1,875 0 0		
Work in Process—Materials—				
Product " y "	900 0 0	1,000 0 0		
Product " z "	500 0 0	550 0 0		
Work in Process—				
Labour	800 0 0	850 0 0		
Work in Process—				
Factory Expense... ...	900 0 0	800 0 0		
Finished Stock	2,750 0 0	3,025 0 0		
		£11,350 0 0		£11,350 0 0

Product "y" and Product "z" both enter into the final finished stock, and no apportionment of labour or factory expense is made in relation to either.

The following are the transactions during the month. The following Raw Materials were purchased and received:—

Raw Materials " a "	Standard £4,750	Actual £4,500
" " " b "	" 3,500	" 3,500
Payroll Accrued	" £5.000	" 5,200

This is divided on a basis of Standard to Direct Labour, but of the £5,000, £500 is Indirect.

Factory Expense Accrued Standard £5,750 (in addition to the Indirect Labour.) Actual 5,500

Materials (all Direct) were issued as follows :—

Materials " a "	Standard £6,000 to Product Y	Actual to be calculated
" " b "	" £4,250 to Product Z	" " " "

Finished Stock used for Factory Repairs and charged to Factory Expense totalled :—

Standard £250 Actual to be calculated

The finished stock used in this connection was taken from the Opening Stock.

Direct Labour is charged to Work in Process (at actual and standard).

Factory Expense is also charged to Work in Process (at actual and standard).

During the period the following units were transferred to Finished Stock—all figures shown at standard:—

Work in Process—	
Materials Product "y"	£5,500
" " "z"	4,000
Direct Labour	4,000
Factory Expense	6,000

The following were the closing stocks at the end of the period, all priced at standard:—

Raw Materials "a"	£1,750
" " "b"	1,000
Work in Process—	
Product "y"	1,000
" "z"	750
Labour	1,000
Factory Expense	1,000
Finished Stocks	2,000

Cost of Sales at Standard was £20,000.

Selling Expenses Accrued during the period were £1,500. Actual.

General Expenses Accrued during the period were £1,000. Actual.

For memoranda purposes, Standard Selling Expense and General Expense rates have been calculated, and the Standard allowance for Selling Expenses was £1,400, and for General Expenses was £1,050.

The total sales made during the period were £27,500, but here again budgeted Selling Rates had been prepared, and for the units sold, the Standard Sales would be £28,000.

It is desired to give effect to the foregoing in the Ledger accounts. These would be shown as under:—

GENERAL LEDGER CONTROL A/c.

	Standard	Actual		Standard	Actual
To Sales		£27,500 0 0	By Balance b/d.		11,350 0 0
Balance c/d.		5,050 0 0	Purchases		8,000 0 0
			Labour		5,200 0 0
			Factory Expense		5,500 0 0
			Selling Expense		1,500 0 0
			General Expense		1,000 0 0
		£32,550 0 0			£32,550 0 0
			By Balance b/d.		5,050 0 0

(This account is used purely as a Balance A/c.)

RAW MATERIALS A/c.
"a"

	Standard	Actual		Standard	Actual
To Balance b/d.	3,000 0 0	£3,250 0 0	By Issues	6,000 0 0	6,000 0 0
Purchases	4,750 0 0	4,500 0 0	Balance c/d.	1,750 0 0	1,750 0 0
	£7,750 0 0	£7,750 0 0		£7,750 0 0	£7,750 0 0
To Balance	1,750 0 0	1,750 0 0			

Price Ratio—£7,750 0 0 divided by £7,750 0 0 — 100.
Actual Cost of Transfers—£6,000 0 0 × 100 — £6,000 0 0.

RAW MATERIALS A/c.

"b"

	Standard	Actual		Standard	Actual
To Balance b/d.	1,750 0 0	1,875 0 0	By Issues	4,250 0 0	4,351 3 0
Purchases	3,500 0 0	3,500 0 0	Balance	1,000 0 0	1,023 17 0
	£5,250 0 0	£5,375 0 0		£5,250 0 0	£5,375 0 0
To Balance b/d.	1,000 0 0	£1,023 17 0			

Price Ratio—£5,375 0 0 divided by £5,250 0 0 — 102.38.

Efficiency Ratio—£5,250 0 0 divided by £5,250 0 0 — 100.

Actual Cost of Transfers—£4,250 0 0 × 102.38 — £4,351 3 0.

WORK IN PROCESS A/c.—MATERIALS.

"y"

	Standard	Actual		Standard	Actual
To Balance b/d.	900 0 0	1,000 0 0	By Finished Stock	5,500 0 0	5,922 18 1
Materials	6,000 0 0	6,000 0 0	Balance c/d.	1,000 0 0	1,077 1 11
	£6,900 0 0	£7,000 0 0		£6,500 0 0	£7,000 0 0
To Balance b/d.	1,000 0 0	1,077 1 11			

Price Ratio—£7,000 0 0 divided by £6,900 0 0 - 101.45.

Efficiency Ratio—£6,900 0 0 divided by £6,500 0 0 — 106.15.

Actual Cost of Transfers—101.45 × 106.15 × £5,500 0 0 — £5,922 18 1.

WORK IN PROCESS A/c.—MATERIALS.

"z"

	Standard	Actual		Standard	Actual
To Balance b/d.	500 0 0	550 0 0	By Finished Stock	4,000 0 0	4,127 4 0
Materials	4,250 0 0	4,351 3 0	Balance	750 0 0	773 19 0
	£4,750 0 0	£4,901 3 0		£4,750 0 0	£4,901 3 0
To Balance b/d.	750 0 0	773 19 0			

Price Ratio—£4,901 3 0 divided by £4,750 0 0 — 103.18.

Efficiency Ratio—£4,750 0 0 divided by £4,750 0 0 — 100.

Actual Cost of Transfers—103.18 × £4,000 0 0 — £4,127 4 0.

WORK IN PROCESS A/c.
LABOUR

	Standard	Actual		Standard	Actual
To Balance b/d.	800 0 0	850 0 0	By Finished Stock	4,000 0 0	4,424 0 4
Payroll	4,500 0 0	4,680 0 0	Balance	1,000 0 0	1,105 19 8
	£5,300 0 0	£5.530 0 0		£5,000 0 0	£5,530 0 0
To Balance b/d.	1,000 0 0	1,105 19 8			

Price Ratio—£5,530 0 0 divided by £5,300 0 0 — 104.34.

Efficiency Ratio—£5,300 0 0 divided by £5,000 0 0 — 106.

Actual Cost of Transfers—104.34 × 106 × £4,000 0 0 — £4,424 0 4.

FACTORY EXPENSE IN PROCESS A/c.

	Standard	Actual		Standard	Actual
To Balance b/d.	900 0 0	800 0 0	By Finished Stock	6,000 0 0	6,081 19 7
Expense Summary	6,500 0 0	6,295 0 0	Balance	1,000 0 0	1,013 0 5
	£7,400 0 0	£7,095 0 0		£7,000 0 0	£7,095 0 0
To Balance b/d.	1,000 0 0	1,013 0 5			

Price Ratio—£7,095 0 0 divided by £7,400 0 0 — 95.9.
Efficiency Ratio—£7,400 0 0 divided by £7,000 0 0 — 105.7.
Actual Cost of Transfers—95.9 × 105.7 × £6,000 0 0 — £6,081 19 7.

FINISHED GOODS A/c.

	Standard	Actual		Standard	Actual
To Balance	2,750 0 0	3,025 0 0	By Repairs	250 0 0	275 0 0
Mat. “ y ”	5,500 0 0	5,922 18 1	Sales	20,000 0 0	21,187 8 0
„ “ z ”	4,000 0 0	4,127 4 0	Balance c/d.	2,000 0 0	2,118 14 0
Labour	4,000 0 0	4,424 0 4			
Factory Ex.	6,000 0 0	6,081 19 7			
	£22,250 0 0	23,581 2 0		£22,250 0 0	23,581 2 0
To Balance b/d.	£2,000 0 0	£2,118 14 0			

Price Ratio—£23,306 2 0 divided by £22,000 0 0 — 105.937.
Efficiency Ratio—£22,000 0 0 divided by £22,000 0 0 — 100.
Actual Cost of Transfers—105.937 × £20,000 0 0 — £21,187 8 0.

LABOUR A/c.

	Standard	Actual		Standard	Actual
To Payroll	5,000 0 0	5,200 0 0	By Distribution	5,000 0 0	5,200 0 0
	£5,000 0 0	£5,200 0 0		£5,000 0 0	£5,200 0 0

FACTORY EXPENSE A/c.

	Standard	Actual		Standard	Actual
To Indirect Labour	500 0 0	520 0 0	By Distribution	6,500 0 0	6,295 0 0
Expenses	5,750 0 0	5,500 0 0			
Finished Stock	250 0 0	275 0 0			
	£6,500 0 0	£6,295 0 0		£6,500 0 0	£6,295 0 0

SELLING EXPENSE.

	Standard	Actual		Standard	Actual
To Selling Expense	£1,400 0 0	£1,500 0 0			

GENERAL EXPENSE.

	Standard	Actual		Standard	Actual
To General Expense	£1,050 0 0	£1,000 0 0			

SALES A/c.

	Standard	Actual
By Sundry Debtors	£28,000 0 0	£27,500 0 0

COST OF SALES A/c.

	Standard	Actual
To Finished Goods	£20,000 0 0	£21,187 8 0

TRIAL BALANCE (ACTUAL).

	Dr.	Cr.
General Ledger Control A/c.		5,050 0 0
Raw Materials "a"	1,750 0 0	
" " "b"	1,023 17 0	
Work in Process, Material "y"	1,077 1 11	
" " " Material "z"	773 19 0	
" " " Labour	1,105 19 8	
" " " Factory Expense	1,013 0 5	
Finished Stock	2,118 14 0	
Cost of Sales	21,187 8 0	
Sales		27,500 0 0
Selling Expense	1,500 0 0	
General Expense...	1,000 0 0	
	£32,550 0 0	£32,550 0 0

INCOME STATEMENT.

		Standard		Actual
Sales		28,000 0 0		27,500 0 0
Less Cost of Sales ...		20,000 0 0		21,187 8 0
Gross Profit		8,000 0 0		6,312 12 0
Less Selling Expense	1,400 0 0		1,500 0 0	
General Expense	1,050 0 0		1,000 0 0	
		2,450 0 0		2,500 0 0
Net Profit		5,550 0 0		3,812 12 0

ANALYSIS OF VARIATIONS.

Standard Net Profit	£5,550 0 0
Actual Net Profit	3,812 12 0
Total Variation	£1,737 8 0
Sales Price Variation	500 0 0
Selling Expense Variation	100 0 0
General Expense Variation	50 0 0*
Manufacturing Variation	1,187 8 0
Total Variation	£1,737 8 0

* denotes actual less than standard.

MANUFACTURING VARIATIONS IN STOCK COMPLETED DURING THE PERIOD.

	Standard	Actual	Variation Index	Variation Amount	Total Variation
Product "y"	£5,500 0 0	£5,922 18 1	Effic. 106.15	338 5 0	
			Price 101.45	84 13 1	
					422 18 1
" "z"	£4,000 0 0	£4,127 4 0	Effic. 100	Nil	
			Price 103.18	127 4 0	
					127 4 0
Work in Process —Labour	£4,000 0 0	£4,424 0 4	Effic. 106	240 0 0	
			Price 104.34	184 0 4	
					424 0 4
Work in Process —Factory Ex.	£6,000 0 0	£6,081 19 7	Effic. 105.7	342 0 0	
			Price 95.9	260 0 5*	
					81 19 7
	£19,500 0 0	£20,556 2 0			£1,056 2 0
	1,056 2 0				
	£20,556 2 0	£20,556 2 0			

* denotes Actual less than Standard.

An example of how the above amounts are calculated is shown hereunder:—

PRODUCT "y."

Efficiency Variance—

£5,500 0 0 × 106.15 — £5,838 5 0 less £5,500 0 0 — £338 5 0.

Price Variance—

£5,838 5 0 × 101.45 — £5,922 18 1 less £5,838 5 0 — £84 13 1.

The whole of the other ratios are arrived at similarly.

It will be noted from the foregoing statement that the manufacturing variation in connection with Stock completed during the period was £1056/2/-, whereas in the Income Statement, the difference between standard and actual cost of sales was £1,187/8/-, a difference of £131/6/-, viz.:—

Variation as per Income Statement	£1,187 8 0
Variation as per Unfinished Stock	1,056 2 0
	£ 131 6 0

This difference is made up as under:—

Price Ratio of Manufactured Stock—

$$\frac{\text{Total Actual Manufacturing Cost of Manufactured Stock during period}}{\text{Total Standard Manufacturing Cost of Manufactured Stock during period}}$$

equals

$$\frac{\pounds 20{,}556\ \ 2\ \ 0}{\pounds 19{,}500\ \ 0\ \ 0} \quad \text{equals} \quad 105.41589.$$

Price Ratio of Total Manufactured Stock—

As per Finished Stock A/c.

$$\frac{\pounds 23{,}306\ \ 2\ \ 0}{\pounds 22{,}000\ \ 0\ \ 0} \quad \text{equals} \quad 105.937.$$

Variation in Cost of Sales—

Manufacturing Variation for Period		£1,056 2 0
(105.41589 of £19,500 0 0)		
Additional Variation on Standard Cost of extra stock sold		
(£500 0 0 × 5.4159)	£ 27 1 7	
(£20,000 0 0 × .52111)	104 4 5	
		131 6 0
Total Variation as per Cost of Sales		£1,187 8 0

Alternative Calculation of Variations.

The foregoing illustration has shown the treatment of Basic Standard Costs in the Ledger accounts, and the calculation of variations arising from the differences between Standard and Actual figures. The figures relating to variations, the types of such variations and the reasons for such can, however, be calculated in a somewhat different fashion, as shown hereunder.

The following figures are assumed in relation to Labour Costs:—

Actual	£12,000 0 0
Standard	£10,000 0 0

In terms of Labour Hours, the figures are:—

Actual	60,000 hours
Standard	48,000 "

Ratios can be calculated from these figures as follows:—

Time Ratio—

Actual Direct Labour Hours	60,000
Standard Direct Labour Hours	48,000
Time Ratio $\frac{60,000}{48,000}$	125

The Labour output is therefore—100 divided by 125—80.

Labour Cost Ratio—

Actual Direct Labour Cost	£12,000
Standard Direct Labour Cost	10,000
Labour Cost Ratio $\frac{12,000}{10,000}$	120

Hourly Pay Ratio—

Labour Cost Ratio	120
Time Ratio	125
Hourly Pay Ratio—120 divided by 125	96

The Hourly Rates of Pay are therefore 96% of Standard.

Proof of this ratio can be obtained in the following manner:—

Actual Hourly Rates of Pay are—£12,000 divided by 60,000	4	0
Standard Hourly Rates of Pay are—£10,000 „ „ 48,000	4	2
Hourly Pay Ratio $\frac{4/-}{4/2}$	96%	

The Labour Cost Ratio can therefore be expressed as the result of paying wages at the rate of 96% of Standard for Time taken at a rate of 125% of Standard.

Expected Ratios.

It has already been indicated that, usually, Basic Standards are treated more as Index numbers than as Budget aims. This is very often referred to as a disadvantage and the Ideal Standard Cost is therefore frequently preferred. It is, of course, possible to prepare the Basic Standards in the first instance in such a way that they will represent something in the nature of Ideals. With the desire to avoid changes in Basic Standards, however, alterations are made only in exceptional circumstances, such as a change of designs. Usually, therefore, even if Basic Standards initially represent ideals, they may soon outgrow their usefulness in this respect.

The wisdom of having something at which to aim is usually acknowledged, and a compromise is possible in connection with Basic Standards to provide this additional advantage, whilst retaining the desirable features ordinarily associated with this method of Standard Costs. This consists of the preparation of Expected Ratios. These represent the figure which should be attained by the business. In the example given previously, two figures only were shown, Standard and Actual. The inclusion of a third figure—the Expected—provides something in the nature of a target figure with which the actual results can be compared, whilst retaining the long term comparisons possible under Basic Standards. The application of the Expected Cost is shown hereunder:—

Actual Labour Cost	£12,000
Expected Labour Cost	£10,800
Standard Labour Cost	£10,000
Actual Labour Hours	60,000 hours
Expected Labour Hours	55,000 hours
Standard Labour Hours	48,000 hours

The Labour Cost ratios would be:—

Actual	120
Expected	108
Standard	100

Compared with Standard, the Actual Labour Cost Ratio is made up of a Time Ratio of 125, and an Hourly Pay Ratio of 96. The Expected Ratio is shown as 108 and this is made up of:

(a) *Time Ratio*—

$\frac{55,000}{48,000}$ 114.58

(b) *Hourly Pay Ratio*—

108 divided by 114.58 ... ... 94.26

The relevant figures covering Actual and Expected results can therefore be shown:—

	Actual Results	Expected Results
Time Ratio	125	114.58
Times Hourly Pay Ratio	96	94.26
Equals—Labour Cost Ratio	120	108

It is now possible to calculate the variations between the Actual and the Expected results. It is this factor which can be made to represent in Basic Standard Costs an examination of the degree of accomplishment.

Time Variation.

It is first of all necessary to ascertain what the cost would have been if the time factor had been as expected and the actual rates had operated. This would be:—

Expected Time Ratio	114.58
At Actual Rates	96
(114.58 × 96 = 109.9968)	110
Actual Cost	120
Variation between Actual and Expected	10

Amount of Variation 10 × £10,000 — £1,000.

Rate Variation.

It has already been ascertained that the ratio of cost if Expected Times had been realised and calculated at Actual Rates was 110. As the Expected Labour Cost Ratio was 108, however, it should be obvious that the variation between 110 and 108 would be due to the Expected Rate varying from the Actual Rate. This is shown hereunder:—

Cost, had Time been as Expected, and Rates at Actual	110
Cost, had Time and Rates been as Expected, i.e., Expected Cost	108
Variation due to difference between Expected and Actual Rates	2

Amount of Variation—2 × £10,000 — £200.

The total variation would therefore be—

Time Variation	£1,000
Rate Variation	200
Total Variation	£1,200

This accords with the difference of £1,200 as shown by subtracting from Actual Labour Cost £12,000, the Expected Labour Cost of £10,800. Thus, it is known at the outset that a task is set which, if realised, would mean that the Total Labour Cost should be £10,800. Actually it is £12,000, a variation of £1,200. By an analysis, as shown above, it can be ascertained that of this £1,200, an amount of £1,000 is due to excess times, and £200 due to excess rates—both in excess of the Expected figures. This can be set out as under:—

Analysis of Labour Cost Variations.

Standard Cost	Expected Cost	Actual Cost	Variation
£10,000	£10,800	£12,000	£1,200

Ratios of Standard—

Actual	Expected	Factors	Variations Increase	%
125	114.58	Time	£1,000	10
96	94.26	Rate	200	2
120	108		£1,200	12%
110	110—Cost had time not varied (114.58 × 96)			
10	2			

Incidental Variation.

The two elements of Time and Rate are, of course, inter-related, and an incidental variation is set up because a change in one affects the other. If, therefore, the calculations are made in such a way as to show for the time and rate variations respectively that amount which would have been saved on each if the loss on the other had been the only change, the total amount of variation would be slightly different from that shown by deducting £10,800 from £12,000. The following statement illustrates this point.

Cost, had time alone not varied from the Expected.			Cost, had rates alone not varied from the Expected.		
Expected Time	114.58		Actual Time	125	
Actual Rates	96		Expected Rates	94.26	
	110 × £10,000—	£11,000		117.82 × £10,000—	£11,782
Actual Cost	£12,000	12,000	Actual Cost		£12,000
Times Loss at Actual Rates		£ 1,000	Rate Loss for Actual Time		£ 218

Total Loss for Time and Rates £1,218
Actual Total Variation — 120 — 108 — 12% × £10,000 ... ... £1,200

Incidental Variation £ 18

The accuracy of the foregoing calculation can be proved as under:—

Increase in Time—10.42 (125 less 114.58) times increase in rates 1.74 (96 less 94.26) equals .1813 times £10,000 — £18.

Spoilage Variation.

In the foregoing example it has been shown that the amount of the time variation between Expected and Actual was £1,000. It may be known that part of this would be due to Spoilage, and it may be desirable to calculate just how much this would be. Furthermore, an Expected amount may have been shown for Spoilage at the beginning of the period and a comparison between the Actual and Expected Spoilage may be required.

In this connection the following figures are assumed:—

Actual Spoilage ...	£600
Expected Spoilage ...	400
Actual Ratio before Spoilage ...	114
Expected Ratio before Spoilage ...	104

The Actual Spoilage Ratio can be calculated by dividing the Labour Cost Ratio (120) by the Actual Ratio Before Spoilage (114)—105.26. It will be remembered that the Actual Time Ratio was 125 and an Efficiency Ratio can be calculated by dividing this by the Actual Spoilage Ratio of 105.26. This gives an Efficiency Ratio of 118.75. Actually this means that an Efficiency Ratio of 118.75 was increased after spoilage to 125.

These figures can also be worked out in relation to the expected figures. Thus the Expected Spoilage would be:—

108 divided by 104 — 103.85.

The Efficiency Ratio would be 114.58 divided by 103.85 giving a figure of 110.33.

The amount of the Spoilage Variation is therefore calculated as under:

Cost had Spoilage been as Expected—	
Expected Spoilage 103.85 times Actual Efficiency 118.75 times Actual Pay Rates 96	118.39
Actual Cost ...	120
Increase through Spoilage Variation	1.61

The amount of the Spoilage Variation would be:—

1.61 times £10,000 — £161.

The Efficiency Variation would be arrived at as follows:—

Cost, if Spoilage had been as expected ...	118.39
Cost, if both Spoilage & Efficiency had been as expected ...	110
Increase through Efficiency Variation	8.39

The amount of the Efficiency Variation would therefore be:—

8.39 times £10,000 — £839.

The Spoilage and Efficiency Variations together give a total of £1,000, viz.:—

Spoilage Variation ...	£161
Efficiency Variation ...	839
	£1,000

This is in agreement with the Time Variation of £1,000 shown previously.

Other Variations.

The foregoing figures have set forth firstly the manner in which ratios are used to determine variations, and, secondly, how some kind of target can be introduced by the provision of Expected Results, also in the form of Ratios. The various figures have been worked out in relation to Labour Costs. They can also be calculated in relation to both Materials and Overhead. Thus, Quantity and Price Ratios can be examined, and variances between Standard and Actual displayed. If Expected Ratios in relation to Material factors are provided, the variances between Actual and Expected can also be shown. In the case of Overhead, there are a number of factors which can be examined, including Unabsorbed Overhead and Spending Variations. The method of approach is the same as shown in connection with Labour, the guiding principle being an analysis of all the variations involved, and the calculation of each in turn.

Comparison of Ideal and Basic Standards.

It has already been indicated that the provision of Expected Ratios is an attempted answer to the advantage frequently enjoyed in connection with Ideal Standards whereby the target is woven into the Standard Cost figure itself. It may be felt that Expected Ratios do not provide the clear cut issue available under Ideal Standards. Nevertheless, it must not be overlooked that the Basic Standard has a very real advantage over the Ideal, inasmuch as it shows both the Standard and Actual figures in the ledger accounts. It therefore avoids the controversy which arises by the calculation of stock figures at standard rates.

In Chapter 22, it was pointed out that the Gross Profit under the First Method of Ideal Standard Costs was £441/11/8, and under the Second Method, £439/11/8. The value of stocks was £602, and £600 respectively.

It will be remembered that this same example was taken to illustrate Basic Standards, and the Standard figures were:—

Sales	£1,620
Less Cost of Sales	1,134
Gross Profit	£ 486

No variations were shown because these figures are automatically adjusted to Actuals in the ledger accounts themselves. The Actual figures were:—

Sales	£1,620	0	0
Less Cost of Sales	1,163	5	2
Gross Profit	£ 456	14	10

The valuation of stocks were as follows:—

	Standard			Actual		
Raw Materials	300	10	0	302	6	0
Work in Process—Materials	112	0	0	112	13	6
,, ,, ,, Labour	30	0	0	29	14	9
,, ,, ,, Expense	40	0	0	43	3	7
Finished Stock	126	0	0	129	5	4
Totals	£608	10	0	£617	3	2

The standards adopted in the Basic Standard Cost illustration were exactly the same as those used for the other two methods. The difference between the Actual Gross Profit under the Basic Standard Cost Method, as against the Actual Gross Profit calculated under ordinary Job Order Costing—£456/14/10, against £450/10/3 is due to the fact that in the Basic

Standard Cost procedure Actuals are arrived at by cost ratios, which take into account the influence of opening and closing stocks.

The question of decision as to which type of standard costs should be adopted is one to be made only after an investigation into the individual circumstances operating in each case. Ideal Standards are much more common than Basic Standards, the reason probably being that they are easier to develop from other cost systems. Without being exhaustive, the respective advantages of each of the methods can be set down as under:—

Ideal Standards.

1. Are more easily developed from other systems, particularly where Budgets are in operation.
2. Readily lend themselves to the use of Budgets, as the background for Standards.
3. Are usually simpler to instal and to operate.
4. Lend themselves to the provision of an ideal against which the degree of accomplishment can be measured.
5. Require no calculations in relation to ratios, nor dual ledger account recording.

Basic Standards.

1. Show both Standard and Actual figures throughout.
2. Avoid controversy in relation to the valuation of stocks at standard.
3. Largely avoid the necessity for a constant revision of standards.
4. Can provide some incentive through the use of Expected Ratios.
5. Give a wider statistical field, particularly in relation to trends.

There can be little doubt that Standard Costs will play an increasingly important part in Cost Accounting. They lend themselves to efficiency to such an extent that in an efficiency-minded age, their value cannot be overlooked. Whilst the description of the two methods given in previous chapters will, it is hoped, illustrate the principles involved, the practical installation of Standard Costs inevitably raises some most intricate but usually most interesting problems. Opportunity is afforded in the case of installation to work out in practical fashion the principles of Standard Costs and to see their development in relation to all phases of a business.

CHAPTER 25.

DISTRIBUTION AND ADMINISTRATION COST STANDARDS.

In Chapter 12, consideration was given to Distribution and Administration Costs. In this chapter, the procedure to be adopted to apportion these costs was outlined. This involved a budget of each type of expense and the development of distribution or administration expense rates. The proportion of the expense chargeable to the product sold was then apportioned on the same principle as operated with manufacturing expense. The difference between the amount of expense appearing in the budget, and the amount apportioned to products would represent the total under or over absorbed.

Whilst these expenses could be apportioned to products it was also indicated that costs were not restricted to a product basis. They could also be ascertained in relation to territories, salesmen, size of orders and other bases. The fundamental principle, however, was that a budget of expense was necessary, that rates be ascertained, and that the expenses be apportioned in respect of actual sales.

If the budget was prepared in terms of individual accounting expenses, such as salesmen's salaries, salesmen's expenses, motor car expenses, telephones, etc., the variances between the budget and actual would also be shown in terms of accounting classification. If, however, expense was budgeted not only in this way, but also in terms of territory or other bases, the variances would be shown in relation to such. Again, if the total expenses directly controllable by a salesman, were controlled in that way the variance between budget and actual would represent expense for which the salesman could be asked to account.

Manufacturing and Distribution Expense.

It has already been indicated that Distribution expense is similar in character to Manufacturing expense. In the latter case, actual expenses incurred can be apportioned at the end of each period to the products or production order affected. This means that the costs are not available until the whole of the expenses relating to the period are known, and there is a consequent delay in arriving at costs. This method of applying actual costs lends itself more to process than to job costs. It has the advantage of accuracy, inasmuch as the figures used are actual results.

Because of the delay, however, resort is often made to predetermined expense rates. These involve the preparation of a budget, the calculation of some acceptable base, and the adoption, as the result of the foregoing, of expense rates which can be applied to products or production orders. These estimates would be most unlikely to correspond exactly with actual figures and the amount of the difference, over or under absorbed expense, is treated in the accounts in the manner described in earlier chapters. Actually the use of predetermined rates is a step towards the use of standards relating to manufacturing expense.

This position also applies to distribution expense. The usual practice (unlike that of manufacturing expense) is to deal with actual distribution costs. It has already been pointed out that many organisations do not allot distribution costs to products, territories, customers or any other bases. They stop short at manufacturing costs.

Development of Distribution Costs.

The development of distribution costs, therefore, can be traced through the following procedure. In the first place, the simplest form of treatment is to apportion the actual distribution costs to the various bases required. Thus, if total distribution cost amounted to £10,000 and there were 10,000 units of product sold, the distribution cost would be £1 per unit. Obviously, the £10,000 would be split into the various accounts which combine to make this total. The matter could become more complex if there were many different types of units being produced. The principle would be the same, but apportionment would be more difficult.

If, however, it was desired not to wait until the end of the period before ascertaining distribution cost rates, resort must be made to predetermined rates, similar to those used in manufacturing. Thus, it may be estimated that there would be 10,000 units sold, and the cost would be £9,000. This would give a unit rate of 18/-. If the actual figures turned out to be 10,000 units and the cost £10,000, there would be an under-absorption of £1,000.

This would again be complicated by division into various distribution accounts, and different types of units. It is, however, the first approach towards a method half-way between actual and standard distribution costs. In Chapter 12, this method was described and it was shown that these costs could be interpreted in relation to such factors as territories, sizes of order, commodities, methods of sale, etc.

Use of Standards.

The use of standards in relation to distribution expense represents a further step towards adequate control. Briefly, it involves decisions in relation to:—

1. A series of estimates covering various units relating to distribution costs, such as number of salesmen, number of miles to be travelled, number of units to be sold, of territories where they will be sold, allowances for expenses, ton miles involved in deliveries.
2. The amount allowable for each element of expense making up total distribution costs.
3. Development of costs relating to the functions required, such as territory distribution costs, product distribution costs, etc.
4. Comparison of actual and standard costs and the calculation of variances.
5. Analysis of variances to show reasons and functional responsibility.

Before proceeding to an examination of the application of Standard Costs to Distribution Expense it should be noted that usually the whole of the expense incurred in a particular period is charged against that period. It is well known that much of the expense may yield results only in future periods, but it is usually taken to be sound accounting practice to disallow any treatment of portion of the expense as deferred charges..

Nevertheless, this factor does create anomalies, because it often happens that Distribution Costs are perhaps highest when sales are lowest. This has the effect of minimising the value of periodical statements.

It has already been indicated that the principle of Standard Costs has not been extended to Distribution Expense to the same degree as with Manufacturing Expense. The reason is probably that the former does not lend itself to standardisation to the same extent as the latter. Many of the factors which affect Distribution Expense cannot be measured in such precise terms that clearly acceptable standards become possible. In any case greater tolerance is usually necessary with Distribution Expense as compared with expense relating to manufacturing operations.

The trend is, however, definitely in favour of a wider use of standards to cover distribution activities, and it is probable that this trend will be accelerated in the future. There is much to be said in favour of the argument that increasing attention will be paid in the future to those expenses which come within the distribution field. It is sometimes found that expenses of this kind amount to more than it costs to manufacture the article, and inquiry is often overdue as to whether this represents an economical position.

Advantages.

The advantages of the use of Standard Costs in relation to Distribution expense can be summarised as under:—

1. It promotes an exhaustive survey into all distribution expenses of the business, so that each is examined in relation to amount, nature and the functional responsibility involved.
2. It ensures a comparison of actual and standard results and shows to those responsible that all such expenses are under continual survey.
3. It exhibits the variances between standards and actuals and promotes a study of these, firstly to inquire into causes, secondly to allocate responsibilities and, thirdly, to promote remedies.
4. It gives valuable information from a managerial angle, particularly in relation to distribution costs as they affect pricing, and also in relation to such matters as differential costs.

Disadvantages.

There are a number of disadvantages, included in which are:—

1. Additional clerical effort is involved. This arises in the first instance from the setting of the standards, secondly the comparison of standards and actuals, and thirdly the tracing of causes of the variances.
2. The standards are often difficult to prepare. Frequently the only basis on which standards can be calculated is that of past activity. This may not be at all acceptable, inasmuch as the errors of the past

are simply included in the standards for the future. Furthermore, much of distribution expense is of such a nature that it is difficult to prepare standards with accuracy.

3. Because of all kinds of conditions which affect distribution expense, it is frequently found that after a thorough examination of variances, little information of value results. This may be because of the nature of the expense, which does not lend itself to action in relation to functional responsibility.

Whilst these disadvantages must be recognised, there are many businesses where the application of standards in relation to distribution expense will yield just as many advantages as with manufacturing. It is true that the standards are frequently more difficult to prepare. It is not possible, for example, to prepare a schedule of expense applicable to a product in the same way as a Bill of Materials can be scheduled. Nevertheless much can be done by means of a careful approach which takes into account fixed, semi-variable, and variable expense, promotes the use of a flexible budget and then proceeds to allocate functional responsibility in relation to each type of expense.

Classification of Fixed and Variable Expense.

The first action therefore is to list the various expenses in such terms. as under:—

Direct Selling Expense.

(a) *Fixed* :

Sales Administration—Salaries and Expenses.
Sales Supervisors—Salaries and Expenses.
Rent of Premises.
Insurance, Depreciation and Maintenance of Sales Facilities.
Portion of Sales Clerical and Office Expense.

(b) *Semi-Variable* :

Portion of Sales Clerical and Office Expense.
Salesmen's Salaries and Travelling Expenses.

(c) *Variable* :

Salesmen's Commissions.
Portion of Clerical Expense.

Advertising.

This would depend entirely upon the method of appropriation, which may quite well, however, be a fixed sum.

Transportation Expense.

(a) *Fixed* :

Rent of Premises.
Insurance, Taxes, Licenses and Depreciation of Transportation Facilities
Administration and Supervision Salaries and Expenses.

(b) *Semi-Variable* :

Portion of Clerical and Office Expense.

(c) *Variable* :

Truck Operation and Maintenance.
Transportation Supplies.
Truck Drivers' Wages.
Carrier Hire.
Portion of Sales and Clerical Expense.

Warehouse Expense.

(a) *Fixed* :

Rent of Premises.
Insurance, Taxes and Depreciation of Warehouse Facilities.
Administration and Supervision Salaries and Expenses.

(b) *Semi-Variable* :

Portion of Clerical and Office Expense.

(c) *Variable* :

Storage Charges.
Warehouse Supplies.
Warehouse Labour.

Credit and Collection Expense.

(a) *Fixed* :

Rent of Premises.
Credit Service Fees and Subscription.
Administration Salaries and Expenses.

(b) *Semi-Variable* :

Portion of Clerical and Office Expenses.

(c) *Variable* :

Portion of Clerical and Office Expense.
Bad Debts.
Commissions.
Legal Expenses.

Financial Expense.

(a) *Fixed* :

Rent of Premises.
Administration Salaries and Expenses.
Clerical and Office Expense.
Interest on Fixed Funds.
Fees and Subscriptions.

(b) *Variable* :

Cash Discounts on Sales.

It should be clearly understood that the above list is given by way of illustration only. An expense which may be fixed in one business may be variable in another. Furthermore, an item may be made up of a fixed element and either a variable or semi-variable portion.

Functional Responsibility.

Not only is it necessary to examine expenses in relation to their fixed and variable elements, but also in terms of functional responsibility. This may be done in a manner similar to the following—

1. *Responsibility of Sales Manager*:

   Salesmen's Salaries and Expenses.
   Salesmen's Commissions.
   Discounts Allowable.
   Sales Clerical and Office Expenses.
   Sales Administration Salaries and Expenses.
   Education and Training Costs.

2. *Advertising Manager*:

   All advertising costs.

3. *Office Manager*:

   Printing and Stationery.
   Postages and Telegrams.
   Office Expenses.
   Insurance.
   Depreciation on Furniture and Fittings.
   Office Salaries and Expenses.
   Exchange.
   Rent and Rates.
   Legal Expenses.

FLEXIBLE BUDGETS.

The first step towards the preparation of standards once the expense elements have been listed and functional responsibility laid down, is to prepare a flexible budget, which will set out the amounts of distribution expense divided into the various expense components affected likely to operate for different ratios of activity. This should be done by a very careful analysis in relation to each expense. Let us suppose, for example, that the item of Salesmen's Salaries is under discussion. At the present time, the sales are £10,000 per annum. It is felt, however, that during the next year, £12,000 can safely be reached. This will require, however, three salesmen in addition to the Sales Manager. The salaries involved will therefore be:—

Sales Manager	£62	10	0
Salesmen	36	2	6
„	36	2	6
„	36	2	6
	£170	17	6

After a thorough analysis, it is anticipated that the sales could be pushed to £18,000 by taking certain steps, one of which would be the provision of an extra salesman. This would mean that the sales of £18,000 would cost, in terms of salesman's salaries, £207. (A full examination of the method of preparing a flexible budget and the calculation of the fixed and variable expense proportions will be found in "Business Budgeting and Budgetary Control," Scott, pages 262 to 264.)

Figure No. 84 shows how the budgeted distribution expense would vary at different volumes of activity.

FIGURE No. 84.

FLEXIBLE BUDGET—DIRECT SELLING EXPENSES.

	Fixed Amount	Variable Rate	Total of Expense for £160,000	Total of Expense for £180,000	Total of Expense for £200,000	Total of Expense for £220,000	Total of Expense for £240,000
Sales Administration Salaries...	£4,000	———	£4,000	£4,000	£4,000	£4,000	£4,000
Salesmen's Salaries	£2,500	15/- per £100	3,700	3,850	4,000	4,150	4,300
Salesmen's Commission ...	———	1½ per cent.	2,400	2,700	3,000	3,300	3,600
Travelling Expenses	£2,000	10/- per £100	2,800	2,900	3,000	3,100	3,200
Advertising	£5,000 to £200,000 £6,000 over £200,000	———	5,000	5,000	5,000	6,000	6,000
Bad Debts	———	½ per cent.	800	900	1,000	1,100	1,200
Sundry Office Expenses ...	£2,000 to £200,000 £2,500 over £200,000	———	2,000	2,000	2,000	2,500	2,500
			£20,700	£21,350	£22,000	£24,150	£24,800

Example of Distribution Expense Standards.

In the preparation of the foregoing it is necessary to pre-determine the bases upon which the figures are prepared, and to illustrate this the following example is given:—

In connection with an organisation it is desired to lay down distribution expense standards, and for this purpose the following figures have been calculated.

Budget for July 194—

Anticipated Sales for Month	£110,000
Averaged Budgeted Sales for Year (Monthly)	125,000
% of July Anticipated Sales to Monthly Average	88%
Number of Salesmen—days travel	1,000
Number of miles of car travel	200,000
Number of Sales Orders	2,000
Number of ton miles Truck Delivery	300,000

Distribution Expense Standards.

1. Sales Administration and Sales Office Salaries and Expenses—20% of Budgeted Salesmen's Salaries and Commission.
2. Salesmen's Salaries and Commission—not above 8% of average budgeted monthly sales.
3. Salesmen's Travelling Expenses (excluding car expenses)—£2/10/- per day.
4. Salesmen's Car Expenses—6d. per mile.
5. Clerical Expense—Handling Orders—15/- per order.
6. Advertising—2½% of Anticipated Sales for the month.
7. Delivery Expense—8d. per ton mile.

Standard and Actual Delivery Expense.

From the foregoing expense the standard delivery expense can be calculated. This is done hereunder, but in addition the actual expenses incurred during the period are also shown.

	Standard	*Actual*	*Variance*
Sales Administration and Sales Office Salaries and Expenses	£2,000	£1,900	£100*
Salesmen's Salaries and Commission	10,000	£9,800	£200*
Salesmen's Travelling Expenses	2,500	2,950	450
Salesmen's Car Expenses	5,000	5,300	300
Clerical Expense—Handling Orders	1,500	1,490	10*
Advertising	2,750	3,100	350
Delivery Expenses	10,000	10,400	400

* Gain

Actual Monthly Bases—

These were as under—

Actual Sales for the Month	£100,000
Number of Salesmen—days travel	1,100
Number of Miles—Car Travel	212,000
Number of Sales Orders	1,920
Advertising	£3,100
Number of ton miles—truck delivery	291,000

Analysis of Standard and Actual Results.

1. Sales Administration and Sales Office Salaries and Expenses :

The budgeted sales were £125,000, and Salesmen's Salaries and Commission were 8% of this—£10,000. An allowance of 20% on this £10,000 would be £2,000. Actually the amount spent is £1,900, therefore £100 is saved. It should be noted that this result is obtained only because there is no variation shown in the average budgeted sales for the year. As it was anticipated that the sales for July would be £110,000, and they were actually £100,000, it is possible that the average budgeted sales would be altered, unless the £10,000 lost in July is recouped in other months.

2. Salesmen's Salaries and Commission.

Standard amount allowed—8% of £125,000—£10,000.

Actual expense was £9,800, showing a saving of £200. It is interesting to note that the budgeted amount of £10,000 on the budgeted July sales of £110,000 would have given a proportionate allowance of £9,100 on £100,000 actual sales. The amount over-spent would therefore be £700, as against the saving of £200, calculated on the basis of average budgeted sales. Probably the saving of £200 may show a more correct position, because the average budgeted sales would be a better basis than one isolated month.

3. Salesmen's Travelling Expenses.

The standard allowance was 1,000 days at £2/10/- per day, that is £2,500.

The actual amount spent was £2,950, the number of days being 1,100. There are therefore, two variances involved—firstly, the efficiency variance of 100 days, which at the budgeted rate of £2/10/- would equal £250, that is £2,750 in all. The difference between this figure and £2,950 actual represents a spending or rate variation of £200. The following conclusions could be drawn from this analysis:—

(a) That there is an excess of 100 salesmen's days.

(b) That there is an excess spending variation of £200.

(c) Despite the foregoing the sales dropped from £110,000 to £100,000.

4. Salesmen's Car Expenses.

It was expected that there would be 200,000 miles of car travel and the cost would be 6d. per mile, giving a budgeted amount of £5,000. Actually, 212,000 miles were run, and the total cost was £5,500. At the budgeted rate, there was an excess of 12,000 miles at 6d. per mile, equalling £300. In addition, there was a spending variation of £200.

5. Clerical Expense.

The expected sales orders were 2,000 and the budgeted cost 15/- per order making £1,500 in all. The actual expense involved was £1,490, covering 1,920 orders. At the budgeted rate of 15/-, the actual number of orders would have cost £1,440. The position, therefore, was that an amount of £60 was saved because fewer orders were received, but an excess of £50 was spent upon those orders which did come in.

6. Advertising.

The allowance shown as a standard was £2,750, but actually £3,100 was spent. This gives an excess of £350 for the month.

7. Delivery Expense.

The standard allowance was for 300,000 ton miles at a rate of 8d. per ton mile, giving a value of £10,000. The actual amount spent was £10,400 despite the fact that only 291,000 ton miles were involved. At the budgeted rate of 8d. per ton mile, the actual mileage run should have cost £9,700. The actual amount spent was £10,400, so that in effect £300 was saved because 9,000 ton miles less than the quantity budgeted was run, but the excess amount spent in running the 291,000 miles was £700.

When the various actual results have been investigated an attempt should be made to determine the functional responsibility in each case. This may involve an additional investigation into each of the expenses included under the various headings established above.

This may show that a single account was the cause of the discrepancy in which case an explanation would be asked of the person responsible for the expense. In this way, not only are the advantages derived from standard costs pushed home to their maximum advantage, but managerial information of great value is obtained.

Having explained the treatment in general, a detailed analysis can now be made in relation firstly to the method of laying down the standard rate and secondly the analysis of the variances resulting from a comparison of standard and actual.

Preparation of Distribution Standard Expense.

It is desired to ascertain the amount of standard expense involved in Sales Salaries and Sales Expenses, and from this information to calculate a standard rate of salary and expense per salesman day. The procedure would be:—

1. *Standard Units* :
   (a) Number of salesmen.
   (b) Number of days per salesman.
   (c) Number of salesmen days.
2. *Sales Salaries* :
   (a) Ascertain the number of salesmen.
   (b) Amount of remuneration.
   (c) Total cost of sales salaries.
3. *Sales Expenses* :
   (a) Ascertain number of salesmen days.
   (b) Amount of allowance per salesman day.
   (c) Total cost of sales expenses.
   (d) Cost per salesman day.

(The amount to be allowed for expense, if not calculated on a fixed salesman day allowance, may be calculated by an analysis of past expense.)

This is a very simple instance of what is involved. Many of the expenses would be calculated after an investigation into costs during previous periods together with a forecast in relation to conditions and operations likely to take place during the budgeted period. Expenses such as Executive Salaries, Executives' Travelling Expenses and Entertainment, Telephone, Insurance, Rates and Taxes, Heat, Lighting and Power, Depreciation, Rent, Donations, and Printing and Stationery would all be the result of an investigation of past figures.

Where it is desired to examine the cost of selling by travelling salesmen in a highly scientific manner, the procedure set out by E. Stewart Freeman in relation to Distribution Costs at the Dennison Manufacturing Company (N.A.C.A. Year Book, 1926, pages 205 to 207) is recommended. The procedure outlined in that case was:—

> " Our next move in connection with distribution costs was to make time studies of the salesmen's job. In 1920, we sent a man out for this purpose to travel one month with a salesman in each of three different types of territory. These studies disclosed some very interesting facts which showed the need of more systematic planning of the salesmen's trips. We found, for example, that only about 15% of the salesman's time was spent face to face with the prospective customer, about 40% or 50% in travelling, and 15% to 25% in waiting for customers, trolleys and trains. It was apparent that if the time with the customer could be increased from 15% to 30% by improving the routing and reducing the waiting time, then the effective time per salesman would be practically doubled. In fact, since then we have demonstrated that in at least some instances this could be done.
>
> During the past two years we have had about eight of our three hundred salesmen furnish reports showing :—
>
> (a) Their expenses in greater detail,
>
> (b) The time of arrival at and departure from each town and each customer's place of business,
>
> (c) The amount and kind of goods sold at each place."

When the budgeted amounts are being prepared in relation to various accounts, a fundamental consideration to keep in mind is the fact that subsidiary standard unit rates may be required in relation to such factors as territories, products, customer classes, etc. It is very often advisable to determine just what ratios are to be prepared in this connection, and the apportionment can then be made when the amount allowable for the particular expense classification is calculated. Examples of this in relation to various accounts are shown hereunder:—

Sales Salaries.

Usually applied to products on basis of relative time spent where this is available. Where this is not possible, sometimes allocated to products on basis of time studies. In other cases on relative sales volume or in certain cases, cost of sales. Allocation to territories is often simple, particularly where a salesman is engaged on only one territory. Other than that, apportionment is made on a time basis.

Travelling Expenses.

Made in a similar manner to Sales Salaries.

Advertising.

Newspaper advertisement can usually be readily apportioned to territories and often to products. Product advertising can be quickly apportioned to products and on basis of products sold, to territories. Radio advertising is similar to that of newspapers. Signs are simple to allocate to territories, and often relatively simple to products. Advertising management expense is often apportioned to both territories and products on the basis of other advertising charges.

Accounting and Clerical Operations.

These can be divided into functions, such as the cost per invoice, the cost per order, the cost per posting, or the cost per customer. In this way, they can be readily attributed to products, order, territories or customers.

Sales Office Expenses.

Usually apportioned according to the relative amounts of direct selling expense relating to various products or territories.

Supervisory Travel.

Usually charged in the same manner as the salaries of the supervisors travelling.

Rent.

Usually charged direct to various locations, and finally spread on the basis of relative charges of direct selling expense applied to each product or customer class.

Research and Development.

Method involved in this case depends upon the precise nature of the charges. Very often these are spread on a relative cost of sales basis.

Bad Debts.

Charged direct to customer classes and then allocated to products on the basis of relative cost of sales of each product.

Credit and Collections.

Usually allocated to products on a sales volume basis.

Treatment of Variances.

In dealing with variances three distinct stages should be noted:—

1. Ascertain the amount of the variance in each account classification.
2. Ascertain the functional responsibility for such variance.
3. Analyse the variance in relation to sub-classifications.

The first two of these require little explanation. The allocation of functional responsibility should be simple providing functional characteristics have been clearly established. The operation in relation to the third condition is shown hereunder:—

It is desired to allocate costs to orders, customers and sales territories, and the following four bases are therefore adopted.

1. Cost per order is obtained by dividing the following expenses by the total number of orders received:—
   (a) Direct Sales effort, including salaries, travelling expenses, entertainment, postages, telegrams and telephone applicable to the sales force.
   (b) Branch office expenses, covering office salaries, printing and stationery, postages, telegrams and telephone, etc.
   (c) Head Office expenses, such as salaries, printing and stationery rent, etc.
2. Cost per invoice obtained by dividing the total cost of the following items, by the number of invoices handled.
   (a) Sales Office expenses, including all clerical work, involved in pricing, extending, typing, and mailing duties.
   (b) Sales Tabulating and Statistics costs.
3. Cost per posting, obtained by dividing the cost of keeping Sundry Debtors' Accounts by the number of postings.

4. Cost per customer is obtained by dividing the total of the following items by the total number of customers :—

(a) Sales Analysis and tabulation costs.

(b) Credit and collection costs.

An allocation of costs to orders would automatically result in their being allocated to customers and from this data it is a simple matter to distribute them to sales territories.

The method of arriving at variances is shown hereunder:—

1. *Territories.*

The following data has been accumulated:—

	A	B	C	D	Total
Standard Salesmen days ...	800	400	300	1,000	2,500
Standard Expense	£1,600	£800	£600	£2.000	£5,000
Standard Rate per Salesman Day	£2	£2	£2	£2	£2
Actual Salesman Days	700	450	250	800	2,200
Actual Expense	£1,575	£900	£450	£1,875	£4,800
Actual Rate per Salesman Day...	£2 5 0	£2	£1 16 0	£2 6 10½	£2 ′3 7⅛

The following are the variances in relation to territories :——

Territory " A " :

Saving—100 less salesmen days at £2 per day £200

Spending Excess—£1,575 less (700 days at £2—£1,400) £175

Net Saving £ 25

Territory " B " :

Excess—50 Salesmen Days at £2 ... ... £100

Territory " C " :

Saving—50 less salesmen days at £2 per day £100

Spending Saving—Standard 250 days at £2 ... ... £500

Less Actual ·450 50

Total Saving £150

Territory " D " :

Saving—200 Less Salesmen Days at £2 ... ... £400

Spending Excess—Actual £1,875

Less Standard—

800 at £2 1,600

275

Net Saving £125

2. *Commodities.*

The relative basic data is as under:—

	Product No. 1	*Product No. 2*	*Product No. 3*	*Product No. 4*	*Total*
Number of Standard Units to be sold	4,000	1,000	2,000	1,000	8,000
Standard Cost of Salesmen's Salaries and Expenses ...	£1,000	£500	£2,000	£1,500	£5,000
Standard cost per Unit ...	5/-	10/-	20/-	30/-	12/6
Actual Units Sold	3,000	1,500	2,000	800	7,300
Actual Cost	£800	£800	£1,800	£1,400	£4,800
Actual Cost per Unit	5/4	10/8	18/-	35/-	13/2

The variances are shown hereunder:—

Product No. 1—

Standard Units	4,000	Standard Cost	£1,000
Actual Units	3,000	Actual Cost	800
Shortage in Units	1,000	Saving in Cost	£ 200

Saving in Units—1,000 units at 5/-		£250
Excess Spending—Actual	£800	
Less—3,000 at 5/-	750	
		50
Net Saving		£200

Product No. 2—

Standard Units	1,000	Standard Cost	£500
Actual Units	1,500	Actual Cost	£800
Excess Units	500	Excess Cost	£300

Excess Units—500 at 10/-		£250
Excess Spending—Actual	£800	
Less Standard— 1,500 at 10/-	750	
		50
Total Excess		£300

Product No. 3—

Standard Units	2,000	Standard Cost	£2,000
Actual Units	2,000	Actual Cost	1,800
Difference	Nil	Saving	£ 200

Difference—Units—	Nil	
Spending Saving	£2,000 Standard	
Less	1,800 Actual	
		£200
Net Saving		£200

Product No. 4—

Standard Units	1,000	Standard Cost	£1,500
Actual Units	800	Actual Cost	1,400
Shortage in Units	200	Saving	£ 100

Saving in Units—200 units at 30/-		£300
Spending Excess—Actual	£1,400	
Less—Standard—800 @ 30/-	1,200	
		200
Net Saving		£100

3. *Salesmen.*

An analysis of standard and actual results in relation to various salesmen is shown in Fig. No. 85.

FIGURE No. 85.

STANDARD AND ACTUAL RESULTS—SALESMEN.

	Budget Sales	Actual Sales	Variance	Budget Expense	Actual Expense	Variance	Standard Unit Expense Rate	Actual Unit Expense Rate
Brown A ..	£50,000	£45,000	£ 5,000 less	£3,000	£3,150	£150 more	£ 6 0 0 per £100	£7 0 0 per £100
Green B ...	£50,000	£40,000	£10,000 less	£2,500	£2,300	£200 less	£ 5 0 0 per £100	£5 15 0 per £100
Black C ...	£40,000	£45,000	£ 5,000 more	£4,000	£3,800	£200 less	£10 0 0 per £100	£8 8 11⅓ per £100
Blue D ...	£30,000	£30,000	———	£2,000	£2,200	£200 more	£ 6 13 4 per £100	£7 6 8 per £100
Grey E ...	£25,000	£30,000	£ 5,000 more	£1.500	£1,800	£300 more	£ 6 0 0 per £100	£6 0 0 per £100
White F ...	£50,000	£40,000	£10,000 less	£2,500	£2,200	£300 less	£ 5 0 0 per £100	£5 10 0 per £100
	£245,000	£230,000	£15,000 less	£15,500	£15,450	£ 50 less		

It will be seen that Budgeted Sales and Expenses have been laid down for each salesman and a standard rate of expense per £100 sales has been calculated. When the Actual results are obtained it will be seen that in all but one case there are variations from the Budgeted Sales. Differences also occur in relation to expense, and calculation of the actual unit expense rates shows differences in all but one instance.

These variances can be analysed into the two causes, viz.:—

Brown	A.	*Quantity Variance—*	
		£5,000 less sales at £6 per £100 Expense Rate	£300 less
		Spending Variance—	
		Actual £3,150, less Standard £2,700	£450 more
		Net Variation	£150 more
Green	B.	*Quantity Variance—*	
		£10,000 less sales at £5 per £100 Expense Rate	£500 less
		Spending Variance—	
		Actual £2,300, less Standard £2,000	£300 more
		Net Variation	£200 less
Black	C.	*Quantity Variance—*	
		£5,000 more at £10 per £100 Expense Rate	£500 more
		Spending Variance—	
		Standard £4,500 less Actual £3,800	£700 less
		Net Variation	£200 less
Blue	D.	*Quantity Variance—*	Nil
		Spending Variance—	
		Actual £2,200, less Standard £2,000	£200 more
		Net Variation	£200 more
Grey	E.	*Quantity Variance—*	
		£5,000 more at £6 per £100 Expense Rate	£300 more
		Spending Variance—	
		Actual £1,800, less Standard £1,800	Nil
		Net Variation	£300 more
White	F.	*Quantity Variance—*	
		£10,000 less at £5 per £100 Expense Rate	£500 less
		Spending Variance—	
		Actual £2,200 less Standard £2,000	£200 more
		Net Variation	£300 less

4. *Delivery Expense.*

The procedure in this case is similar to that of selling expenses. It is necessary to arrive at standard rates of expense, and the procedure would be:—

1. List the various methods of delivering goods.
2. Tabulate the various expenses relating to each method.
3. Decide upon the unit base to be adopted.
4. Calculate the standard rate per unit.

It will usually be found that these expenses readily lend themselves to a division under fixed, semi-variable and variable. For example, depreciation of trucks, registration and insurance would be fixed, whilst items such as petrol, oil, and tyres would largely be variable. Repairs would probably be semi-variable.

When this information has been gathered, it should be possible to prepare a schedule similar to the following:—

	Own Delivery Trucks	Rail and Boat Delivery Trucks	Hire Trucks	Total
Standard Truck Miles	10,000	2,000	4,000	16,000
Standard Ton Miles	20,000	8,000	20,000	48,000
Standard Expense	£750	£200	£1,000	£1,950
Standard Cost per Ton Mile	9d.	6d.	1/-	9¾d.
Actual Truck Miles	8,500	1,900	3,000	13,400
Actual Ton Miles	18,000	8,200	14,000	40,200
Actual Expense	£730	£200	£800	£1,730
Actual Cost per Ton mile	9.733d.	5.85d.	1/1.71	10.3d.

The following variances can be calculated:—

1. *Own Delivery Trucks*—

Saving in mileage—Standard	20,000		
Less Actual	18,000		
	2,000	miles at 9d.	£75
Excess Cost—Actual	£730		
Less Standard—1800 @ 9d.	675		
			55
		Net Saving	£20

2. *Rail and Boat Delivery Trucks*—

Excess Mileage—Actual	8,200		
Less Standard...	8,000		
	200	miles at 6d.	£5
Spending Saving—Standard	£205		
Less Actual	200		5
		Net Difference	Nil

3. *Hire Services*—

Saving in Mileage—Standard	20,000		
Actual	14,000		
	6,000	miles at 1/-	£300
Excess Cost—Actual	£800		
Less Standard—14,000 @ 1/-	700		
			100
		Net Saving	£200

It now becomes possible to make a further analysis in relation to the delivery expenses of the trucks operated by the Company. The relative information, both in relation to Standard and Actual figures is shown hereunder:—

FIGURE No. 86.

STANDARD AND ACTUAL TRUCK DELIVERY EXPENSE

	Truck No. 1		Truck No. 2		Truck No. 3		Truck No. 4		Truck No. 5	
	Standard	Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard	Actual
Mileage	2,000	1,700	1,500	1,500	3,500	3,250	1,500	1,900	1,500	1,600
Tow. Miles	2,500	2,000	3,000	2,500	7,000	6,000	3,750	3,500	3,750	4,000
Petrol	£15 0 0	£14 0 0	£18 0 0	£16 0 0	£45 0 0	£40 0 0	£30 0 0	£25 0 0	£30 0 0	£35 0 0
Oil	2 0 0	2 0 0	3 0 0	3 0 0	5 0 0	5 0 0	4 0 0	4 0 0	4 0 0	4 0 0
Tyres	3 0 0	3 0 0	4 0 0	4 0 0	8 0 0	7 0 0	8 0 0	8 0 0	8 0 0	8 0 0
Repairs	10 0 0	12 0 0	25 0 0	22 0 0	35 0 0	30 0 0	40 0 0	45 0 0	40 0 0	35 0 0
Depreciation, Registration, Insurance and Sundries ...	7 10 0	7 0 0	15 0 0	13 0 0	60 15 0	60 0 0	35 10 0	34 0 0	35 10 0	38 0 0
Drivers Wages ...	25 0 0	24 0 0	35 0 0	33 0 0	58 15 0	60 0 0	70 0 0	64 0 0	70 0 0	75 0 0
Total	£62 10 0	£62 0 0	£100 0 0	£91 0 0	£212 10 0	£202 0 0	£187 10 0	£180 0 0	£187 10 0	£195 0 0
Cost per ton mile...	6d.		8d.		7¼d.		1/–		1/–	

The first analysis should be in terms of accounts. In the case of petrol, for example, the standard cost per mile was £138 for 20,000 ton miles, that is, 1.656d. per mile. The actual cost was 1.733d. per mile (£130 divided by 18,000). The relative figures for Truck No. 1 were Standard 1.44d. per mile, and Actual 1.68d. per mile. The figures relating to the other trucks could be calculated in similar manner. This procedure could also be adopted in relation to each of the other expenses, and if it was found that any expense varied considerably, the matter should be taken up through functional responsibility.

The variations in cost relating to each truck are shown hereunder:—

Truck No. 1—

Standard Cost		£ 62 10 0
Actual Cost		62 0 0
Saving		10 0
Saving in mileage—500 miles at 6d.		12 10 0
Excess Cost—Actual	£62 0 0	
Less Standard—2,000 @ 6d.	50 0 0	
		12 0 0
Net Saving		10 0

Truck No. 2—

Standard Cost		100 0 0
Actual Cost		91 0 0
Saving		9 0 0
Saving in Mileage—500 miles at 8d.		16 13 4
Excess Cost—Actual	91 0 0	
Less Standard—2,500 @ 8d.	83 6 8	
		7 13 4
Net Saving		9 0 0

Truck No. 3—

Standard Cost		212 10 0
Actual Cost		202 0 0
Saving		10 10 0
Saving in Mileage—1,000 miles at 7²⁄₇d.		30 7 0
Excess Cost—Actual	202 0 0	
Less Standard Cost—6,000 miles at 7²⁄₇d.	182 3 0	
		19 17 0
Net Saving		£10 10 0

Truck No. 4—

Standard Cost		187 10 0
Actual Cost		180 0 0
Saving		7 10 0
Saving in Mileage—250 miles at 1/-	12 10 0	12 10 0
Excess Cost—Actual	180 0 0	
Less Standard—3,500 at 1/-	175 0 0	
		5 0 0
Net Saving		£7 10 0

Truck No. 5—

Actual Cost		195 0 0
Standard Cost		187 10 0
Excess		7 10 0
Excess Mileage—250 at 1/-		12 10 0
Spending Saving—Standard—4,000 at 1/-	£200 0 0	
Less Actual	195 0 0	
		5 0 0
Net Excess Cost		£7 10 0

WAREHOUSE EXPENSE.

The following expenses may be included under this heading:—

Rent of Warehouse,
Bulk Store Costs,
Packing & Shipping Supplies,
Freights,
Printing & Stationery,
Postage, Telephone & Telegraphic Expense,
Stores, Supplies,
Insurance,
Motor Cars and Trucks,
Warehouse Labour,
Packing Labour,
Supervision.

In order to arrive at standards, the first step would be to take each account singly and examine it, firstly, upon a functional basis, and, secondly, in relation to its composition in terms of Fixed and Variable Expense. This may be done as under:—

1. Rent of Warehouse.

This may be fixed in amount. The warehouse may be sufficient for all practical purposes, and there may be no possibility of any extra space having to be taken to take care of current requirements. This amount may therefore be set down as a Fixed amount.

2. Bulk Store Costs.

These should be analysed and those that are fixed segregated, whilst in the case of the variable expenses an analysis should be undertaken to see what is the factor which causes the variation. It may be found that there are no variable expenses, because the account may be made up of Lighting, Heating, Power, and cleaning, none of which would vary in relation to any such factor as the number of orders handled in the bulk store. This may therefore be regarded as a fixed expense under these circumstances.

3. Packing and Shipping Supplies.

This may in the main be variable, though there may be some fixed elements included. The exact unit to use would depend upon the individual circumstances operating. In the case of packing, it may be found that a very close estimate can be obtained, by calculating the packing involved in a standard product, particularly where this was the only product sold. If this was done and the number of products to be estimated as being budgeted for packing during the period calculated, the amount allowable for packing should be easily computed. In this case, there may be an allowance for fixed expense of £50 and an estimate that the cost of packing for each order was 6d., and therefore for 40,000 units, the total expense allowable would be £1,050 (£1,000 being variable). If at the end of time it was found that 30,000 products had been packed, and the expense was £950, it could be ascertained that there was a variance between budgeted and actual products packed of 10,000 units, representing a deduction of 25% on the budget, and the spending variance in relation to Packing would be £250, which would be arrived at:—

Budget—Fixed	£50	
Plus 40,000 Units @ 6d.	1,000	
		1,050
Actual—Fixed	50	
Plus 30,000 units @ 6d.	750	
		800
	Variance	£250

Shipping supplies would be considered, not in relation to the goods to be packed, but goods to be shipped, as this, of course, would be the only relevant factor.

Analysis of Variances.

The procedure previously outlined in relation to variances relating to selling costs can also be applied to warehouse expenses. An example of this is given hereunder in relation to size of orders,—and the costs of handling such. The necessary data is :—

	Under 1 cwt	1 cwt to 5 cwt	5 cwt to 1 ton	Over 1 ton	Total
Standard No. of Orders	2,000	3,000	4,000	500	9,500
Standard Cost...	£1,000	£2,250	£4,000	£625	£7,875
Standard Unit Cost	10/–	15/–	20/–	25/–	
Actual No. of Orders	2,500	2,500	3,000	800	8,800
Actual Cost	£1,500	£2,000	£2,700	£960	£7,160
Actual Unit Cost	12/–	16/–	18/–	24/–	

The total saving is:—

Standard Cost	£7,875
Actual Cost	7,160
	£ 715

Difference in Units:—

Standard	9,500
Actual	8,800
	700

The variances in relation to sizes of orders are:—

Under 1 *cwt.*—

Excess Orders—500 at 10/–	£250
Excess Spending	250
Total Excess	£500

1 *cwt to* 5 *cwt*—

Saving in orders—500 at 15/-	£375
Excess Spending	125
Net Saving	£250

5 *cwt to* 1 *ton*—

Saving in order—1,000 at 20/-	£1,000
Spending Saving	300
Total Saving	£1,300

Over 1 *ton*—

Excess Orders—300 at 25/-	£375
Saving Expenses	40
Total Excess	£335

The foregoing procedure will indicate the method to be followed in arriving at variations in connection with distribution expense. Obviously, an investigation of variances can be carried much further if desired. By having more elaborate controls it is possible to trace variances to exact causes and virtually to exercise the same degree of control over selling costs as is now being practised more generally in relation to manufacturing expense.

Accounting Treatment.

Where no attempt is made to spread distribution expense the amounts involved are naturally collected in the various expense accounts and find their way accordingly into the Profit and Loss Account. Where predetermined rates are used, and are applied through the accounts, the procedure is as explained in Chapter 12.

With the adoption of Standard Costs, two alternatives are available. In the first place, the standards can be used only for statistical purposes, or, secondly, they can be incorporated in the accounts. If the former is the case, the procedure can be the same as with actual costs or predetermined costs. Where, however, the standard cost system operates, and the various distribution expenses find their way into the accounts, it is essential that variance accounts be opened to record the types of variances discussed in the foregoing pages.

In connection with the figures shown for Delivery Expense and particularly those used in connection with Own Delivery Trucks, a further analysis would show that the Petrol Requisition Summary may appear as under:—

PETROL REQUISITION SUMMARY.

To Petrol Requisitions	By Delivery Expenses—	
Truck No.	Own Trucks	£130
” ”	Boat & Rail Trucks	30
” ”		
” ”		
” ”		

A comparison of Actual expense incurred as against the Budget allowed might appear as under:—

BUDGET & ACTUAL.

	Budget	*Actual*	*Variance*
Petrol	£138 0 0	£130 0 0	£ 8 0 0*
Oil	18 0 0	18 0 0	
Tyres...	31 0 0	30 0 0	1 0 0*
Repairs	150 0 0	144 0 0	6 0 0*
Depreciation Registration Insurance Sundries	154 5 0	152 0 0	2 5 0*
Drivers' Wages	258 15 0	256 0 0	2 15 0*
	£750 0 0	£730 0 0	£20 0 0*

* Denotes Gain.

The foregoing information could find its way into the accounts in a manner similar to the following:—

DELIVERY EXPENSE—OWN TRUCKS.

	Standard	*Actual*		*Standard*	*Actual*
To Sundry Exs.	£750	£730	By Delivery Charges ...	£675	£675
			„ Gain in Mileage ...	75	
			„ Spending Variance ...		55
	£750	£730		£750	£730

DELIVERY EXPENSE—RAIL AND BOAT DELIVERY TRUCKS.

	Standard	*Actual*		*Standard*	*Actual*
To Sundry Expenses ...	£200	£200	By Delivery Charges ...	£195	£205
„ Spending Variance ...		5	„ Gain in Mileage ...	5	
	£200	£205		£200	£205

DELIVERY EXPENSES—HIRE TRUCKS.

	Standard	*Actual*		*Standard*	*Actual*
To Sundry Expenses ...	£1,000	£800	By Delivery Charges ...	£700	£700
			„ Gain in Mileage ...	300	
			„ Spending Variance ...		100
	£1,000	£800		£1,000	£800

SPENDING VARIATION

To Excess Costs—		By Savings—	
Own Trucks...	£55	Rail & Boat Delivery Trucks	5
Hire Trucks...	100	Profit & Loss A/c.	150
	£155		£155

COST TO MAKE AND SELL.

To Manufactured Cost of Sales	£x
„ Selling Expenses	y
„ Delivery Expenses	1,580

SALES A/c.

By Sales	£z

If the foregoing procedure was carried through to its logical conclusion, an Income Statement similar to the following would ultimately be prepared:—

Budgeted Sales—50,000 units @, say, £1		£50,000
Less Budgeted Cost—50,000 units at —		
Cost to manufacture 10/-	£25,000	
„ „ sell & administer 4/-	10,000	
„ „ deliver 2/-	5,000	
		40,000
Budgeted Net Profit		£10,000
Less Variance in Budgeted Sales— 5,000 units @ £1	£5,000	
Less Budgeted Cost 5,000 units @ 16/-	£4,000	
		1,000
Budgeted Profit on Actual Sales		£9,000
Less Variances in Cost—		
Cost of Manufacture—(as per Variance A/cs)	£1,150	
Cost to Sell & Administer—(as per Variance A/cs)	450	
Cost to Deliver—(as per Variance A/cs)	150	
		1,750
Actual Net Profit		£7,250

It is not suggested that this procedure should be adopted in relation to Standard Distribution Costs, unless special circumstances are involved which make it very desirable that the variances should be carried through the cost accounts. Very often all the managerial information necessary can be obtained by the treatment of variances in statistical returns. However, if it is desired to incorporate distribution standards in the accounts a method based on or similar to the foregoing may be worked out, though the actual method adopted would take into account special conditions operating.

Administration Expense.

This matter was dealt with in general terms in Chapter 12. Some consideration was given to the various expenses included under this heading and the adoption of pre-determined expense rates was examined. Reference was also made to the method whereby predetermined rates could be used.

If desired, Standard Administration Expense Unit Costs can be developed in the same way as Distribution Unit Costs. Usually it is necessary to undertake a survey to obtain information on which ratios for clerical operations can be estimated. Subjects in such a survey would include the following:—

1. Floor space per clerk.
2. Cost of Stationery and Supplies.
3. Cost of equipment and machinery.
4. Obsolete equipment.
5. Time requirement by orders.
6. Standards for fourteen clerical jobs as under—
   (a) Addressing envelopes.
   (b) Typing copywork.
   (c) Fill-in letters.
   (d) Typing from shorthand.
   (e) Typing from dictation machine.
   (f) Invoice typing.
   (g) Order writing.
   (h) Filing.
   (i) Addressing.
   (j) Duplicating.
   (k) Tabulating.
   (l) Calculating.
   (m) Invoicing.
   (n) Bookkeeping.
7. Office lighting.
8. Clerical Salaries.

When this information has been obtained and estimates have been made in relation to the amount of expense involved, it becomes possible to lay down certain standard rates. These would then be treated in the same way as other standard costs and by a comparison of standards and actuals, variances could be developed. It should be obvious that this may be a valuable method of seeing that administration expense is kept within bounds.

CHAPTER 26.

EXECUTIVE AND MANAGERIAL STATEMENTS.

The primary purposes of cost accounting are firstly to improve efficiency by the presentation of cost data which will enable management to manage more efficiently, and secondly to disclose the costs of products. In order to give effect to these aims, statements prepared by cost accounting sections for the use of management must be such as to give to executives the information of most value to them.

Where a system of standard cost accounting is in operation, the cost accountant is better able to focus attention upon the principle of exceptions, which is one of the most valuable so far as management is concerned. With the large number of matters which usually come before the executives in charge of an organisation, there must, of necessity, be some sifting of the work, and this is best done by the avoidance of those factors which are going according to schedule, and concentration upon those which are not. As standard costs are based upon the principle of variations, the cost accountant dealing with standard costs is in a unique position to prepare statements which will be of the greatest value to management in directing the fortunes of an organisation. Outlined hereunder will be found a brief description of information which can be routed through to the executives, and which should enable them to keep their fingers upon the pulse of the whole of the operations of the business, and speedily recognise those matters which merit immediate or early attention. With most organisations operating on standard costs, the central point of all managerial statements is the profit and loss account which is, of course, designed to show the net profit for the month.

A typical set of managerial statements would be:—

1. Monthly Income Statement.

This is designed to set forth the net profit (or loss) for the month, together with sales, cost of sales, gross profit, general and selling expense, and variations. See Figure No. 87. Provision is usually made for a cumulative figure, representing the results for the year to date to be shown. Sometimes an extra column is provided to show the results for the same month of the previous year, though very often the income statement for the relevant month of the previous year is attached to the current month's statement. Provision is also usually made for certain vital percentages to be shown, as, for example, cost of sales to sales, gross profit to sales, net operating profit to sales. Most of the remainder of the statements supplement this income statement, and analyse in more detailed fashion its constituent accounts.

FIGURE No. 87

INCOME STATEMENT.

Month of..................

	This Month	%	Year to Date	%
Sales (Net)				
Cost of Sales (Net)				
Gross Profit				
Selling Expenses				
General Expenses				
Operating Profit at Budget				
Summary of Variations :				
Material Price				
Material Quantity				
Labour Rates				
Labour Efficiency				
Factory Expense —				
Idle Time				
Quantity				
Spending				
Selling Expense				
General Expense				
Net Operating Profit				
Other Income :				
Other Expense				
Net Profit				

1. Cost of Sales to Sales %
2. Gross Profit to Sales %
3. Budgeted Operating Profit to Sales %
4. Net Operating Profit to Sales %
5. Net Profit to Sales %

FIGURE No. 88.

NET PROFIT ANALYSIS.
(Standard and Actual).

..................................*Factory*. *Date*..................

Product Class	Standard	Actual	Variance	%	Remarks
A 101 A 102 A 103 A 104 etc.					

FIGURE No. 89.

NET PROFIT ANALYSIS
(By Product Class).

..................................*Factory*. *Date*..................

Product Class	Sales	Gross Profit	%	Selling and Administration Expense	%	Net Profit	%
A 101 A 102 A 103 A 104 etc.							

FIGURE No. 90.

GROSS PROFIT COMPARISON.

.................................*Factory.* *Date*.....................

Product Class	Month of..............				Year to Date.........			
	Budget	Actual	Variance	%	Budget	Actual	Variance	%

FIGURE No. 91.

GROSS PROFIT ANALYSIS.

.................................*Factory.* *Date*................

Product Class	Sales	Cost of Sales	Gross Profit	%	Remarks

2. Net Profit Analysis.

This can be covered by two statements.

(a) Budget and Actual Net Profit by product class.

This statement presupposes the use of a budget. Budgetary control in general is simplified where standard costs are in operation. So much of the detail necessary in connection with standard costs can be used for the preparation of relevant budgets, that the two go hand in hand. The statement above referred to shows the budgeted and actual net profit relating to each product class within the organisation, and usually an extra column is provided for variances. See Figure No. 88. Where net profit is less than budget, the amounts can be shown in red and the attention of management can, if need be, be directed to these. Those products still being produced at a loss are readily shown, and any product class singled out for attention can be examined in more detail by passing through to the cost of sales, each element included therein, and if need be the standards set. This statement sometimes provides for not only the month's results, but for a cumulative figure, showing the year to date.

(b) Actual Sales, Gross Profit, Selling and Administrative Expense, and Net Profit analysis, by style or product class.

This statement shows only actual results, but the vital statistics in relation to each product class are included. See Figure No. 89. At times an extra column is provided for selling and general expense.

3. Gross Profit Analysis.

This is also carried out by a number of statements.

(a) Budget and Actual Gross Profit by product class.

This is similar to statement No. 2 (a), except that it focuses attention upon the gross profit position. Again adverse variances can be shown in red. The statement can confine its attention to the month's results, or can provide extra columns to show the cumulative position during the financial period. See Figure No. 90.

(b) Actual Sales, Cost of Sales and Gross Profit analysis.

These results would be shown in relation to every product or style number, any lines upon which a gross loss has been made, being shown in red. Again provision can be made for monthly and cumulative figures. See Figure No. 91.

4. Cost of Sales Analysis.

This takes the form of an analysis by product class or style number, showing both budget and actual figures. Adverse variations could be shown in red, and a report could be called for in the case of any which

FIGURE No. 92.

SALES AND COST OF SALES ANALYSIS.

Product.

Factory.................................... *Date*..................

Style No.	Size	Quantity	Unit Cost	Total Cost	Sales Value	Gross Profit	Remarks

FIGURE No. 93.

DEPARTMENTAL EXPENSE ANALYSIS.

Factory.................................... *Date*..................

A/c. No.	Account	Budget	Actual	Variance	%

are sufficiently serious to warrant further investigation by management. These could then be broken down into the various cost elements showing the variances in relation to each. See Figure No. 92.

5. Sales Analyses.

The degree of analysis carried out in connection with sales, depends upon the statistical detail available within the organisation. The statements prepared can set forth so much detail that the main factors may be overlooked. It is wise, therefore, to concentrate upon essentials. The sales statements could be prepared in relation to:—

(a) Territories,
(b) Salesmen,
(c) Customers,
(d) Products,
(e) Size of orders.

Further analyses can also be made if the statistics are available. Where sales quotas are set, the statements can be made to show both budget and actual, particularly in relation to territories, salesmen, customers, and, if need be, products. See Chapter No. 25. As with all other statements. the matters for attention, by management should be shown in red.

6. Selling Expense Analysis.

This is usually carried out by a comparison between budget and actual expenditures in relation to each type of selling expense, and analyses can also be made in relation to territories or salesmen.

7. Administrative Expense Analysis.

This comparison is between budget and actual expense together with variances. It is usually possible to budget fairly closely for this type of expense, on account of the fact that much of it is of a fixed nature.

8. Departmental Expense Analyses.

The factory expenses applicable to each department should be examined in relation to the variances resulting from a comparison between budget and actual. See Figure No. 93. On account of the rate of productive activity having a direct effect upon the amount of the departmental expense, statements are sometimes prepared setting forth this factor as a cost per unit produced.

9. Financial Statement.

Particularly where cash resources are somewhat limited, a monthly financial statement is frequently included. Where a cash budget is in operation, the actual results would be compared with the budget. Sometimes these figures are supplemented by comparisons with previous months, or the same month of the previous year. Usually trends should be indicated. Where it is desired to keep control over capital expenditure, the amounts spent month by month may be separately shown in the financial statement. In addition to displaying the cash position, this statement

FIGURE No. 94.

QUALITY REPORT.

Factory.................................... *Date*..................

Style Number	Total Production	Firsts	Seconds	%	Other	%

FIGURE No. 95.

QUANTITY REPORT.

Factory.................................... *Date*..................

Style or Product No.	Budget	Actual	Variance	%

may set forth the current asset, current liability position, and may include comparative statements of opening and closing stocks.

10. Production Analyses.

Whilst most of the foregoing statements would be applicable to almost any type of organisation, the exact nature of managerial statements relating to production would depend upon the type of business being operated. The following statements may, however, be considered representative:—

(a) Quality Report.

This is a most important statement, as profits can be seriously impaired by spoilt materials or by excess production of seconds or thirds. It is usually advisable to set a budget standard for the proportion of inferior grades allowable, and a statement would be supplied showing how the actual results compared with the budget. This statement is not only valuable for the managing director, but highly important to the works manager and the foremen. Improvement in quality is one of the surest ways of raising net profit and of increasing the goodwill of the organisation. See Figure No. 94.

(b) Production Quantities.

The use of standard costs almost always involves a good system of production control, and this is facilitated by the use of production budgets which are used for planning and routing the work. The production budget may be for one, three, six or twelve months, but it should be carefully prepared, and where production is specified for each individual month the number of working days should be carefully calculated. Often with something in the nature of repetitive work, daily production is ascertained and from this weekly and monthly figures are calculated. It then becomes possible to prepare intermediate reports weekly or fortnightly so that any lag in production can be taken up before it assumes serious proportions. At the end of the month the budgeted production in relation to each product or style should be shown. This statement would usually refer to the finished product, but subsidiary statements should show the result for each department. Usually if submitted in full detail, the main conclusions to be drawn may be lost in a mass of figures, and it is usual therefore to attach a summary, which particularly sets forth those production factors requiring attention.

(c) Units Produced.

Where a bonus system is in operation and labour units have been calculated and prepared, a comparison between units produced and units budgeted for in the production budget frequently discloses adverse features not readily ascertained from any other source. These provide valuable statistics in disclosing where the bottlenecks are, and whether all sections of the plant are being asked to deliver an adequate share of work. Furthermore, the units can be used as an index to labour efficiency and to the excess labour costs which are occurring. See Figures Nos. 96, 97 and 98.

FIGURE No. 96.

UNIT ANALYSIS.

Factory........................ *Department*........................ *Date*..................

No.	Operation	Month			Year to Date		
		Budget	Actual	Over or Under Absorbed	Budget	Actual	Over or Under Absorbed

FIGURE No. 97.

UNIT ANALYSIS OF OPERATING RESULTS.

Factory........................ *Department*........................ *Date*..................

	This Month	Year to Date
Budgeted Units		
Actual Units Produced		
Budgeted Unit Rate		
Actual Spending Rate		
Budgeted Overhead Amount	£	£
Overhead Absorbed in Production	£	£
Amount Actually Spent for Period	£	£
Net Variation for Period	£	£

FIGURE No. 98.
LABOUR REPORT.

Department...

For Week Ending....................................

Emp. No.	Name	Actual			Value of Production		Efficiency			To Date			Summary of Standing Orders				
		Prod. Time	Rate	Productive Wages	Stand. Time	Labour Value	% Prod. to St. Time	Loss	Gain	% Prod. to St. Time	Loss	Gain	Standing Order No.	Amount	Budget	Loss	Gain

Either at the same time as the foregoing statements are supplied monthly, or at some other suitable occasion, budget statements relating to the coming period should be routed through to management. Typical statements of this nature would be:—

1. Net Profit by product class.
2. Gross Profit by product class.
3. Cost of Sales by product class.
4. Production Budget by products, and by departments.
5. Departmental Expenses by departments.
6. Sales, appropriately divided.
7. Selling Expense Budget.
8. Administrative Expense Budget.

Receipt of these budgets would enable management to obtain a pre-view of the anticipated results for the next period. If these were not considered satisfactory, an opportunity would be available to ask for amendments in the desired direction. For example, the net profit position may not be considered satisfactory, and it may be necessary to give consideration to a concerted attempt to sell more of those lines which carry a higher rate of net profit. Similarly it may be discovered that the sales demands on the factory are such as to cause a disturbing amount of idle time, and a number of idle machines. Management may decide that this position must be rectified and a sales campaign may be decided upon to rectify the position.

The above mentioned statements are indicative, though obviously each organisation should prepare those statements which confer the most advantages. As stated at the outset of this chapter, the cost accountant is in a unique position to fulfil the needs of management, and he is frequently in a position to be the first to discover adverse factors to which the attention of management should be drawn. He will best fulfil his function if he bears this fundamental factor in mind at all times, and operating with a system of standard costs gives him an excellent opportunity to prove his worth.

CHAPTER 27.

RELATIONSHIP BETWEEN BUDGETED, STANDARD AND ACTUAL COSTS.

As this volume primarily concerns Cost Accounting, no attempt is made to deal with Budgetary Control. It is necessary, however, that some attention be paid to the relationship existing between cost accounting budgeting and standard costs, particularly with a view to ascertaining just how these can be used to maximum advantage.

The following example (taken from the writer's book—"Business Budgeting"*) is designed to show the method of operation used to display the results shown from budgets, standards and actuals. Obviously a comparison of this kind is possible only where complete information in relation to individual costs is available.

"It can be assumed that there are three products, A, B and C, and at an estimated normal capacity of £100,000 sales, £30,000 would be of Product A, £30,000 of Product B, and £40,000 of Product C. An analysis of costs is set out in part (a) of Figure No. 1, Budgeted Standards. It will be seen that the profit on Product A is 38 per cent., on Product B is 37.5 per cent., whilst on Product C it is only 5 per cent. A table is also given showing the combined results of A, B and C. When the Budget is prepared, the forecasted sales totals are A £20,000, B £24,000 and C £36,000, making £80,000 in all. At the rate of profit based on normal capacity the amount of profit for this programme would be £18,400. During the period, certain happenings occurred which reduced actual sales considerably and meant that the totals reached were: A £15,000, B £18,000 and C £27,000, making £60,000 in all. Actual production which was originally budgeted for in accordance with sales totals varied from the actual sales, and based on selling values the figures were A £18,000, B £12,000 and C £30,000. Whilst the total production was the same in amount as the sales, the stock of Product A was increased by £3,000 (selling value) Product B was £6,000 less, and Product C £3,000 more. Though, therefore, the selling totals of production and sales were the same, actually stock was increased by £645 when these differences in the various products were taken into account at standard manufacturing cost. The profit on actual sales at the normal capacity standard rate would be £13,800. The variation in manufacturing expense would be £1,420, which would mean that this was the amount that manufacturing expense had exceeded what it should have been at normal capacity rates. In other words, because of decreased production, manufacturing expenses exceeded estimates by £1,420. Similarly, the variation in selling expense on account of smaller sales was £1,610. Section (c) of this figure shows the profit on turnover of £60,000 based, firstly, on normal capacity standard cost rates. Allowing for the variation in volume which made differences of £1,420 in Manufacturing Expenses, £800 in Administrative Expenses, £1,160 in Selling Expenses, and £395 in Financial Expenses, the net profit was £10,235, making a difference of £4,225 shortage due to decrease in sales volume. This figure of £10,235 represents the budgeted profit on the actual sales volume and it becomes necessary to compare this with the actual profit shown by the Profit and Loss Statement. An analysis of the two sets of figures shows that the following increases over budgeted figures were sustained:—

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*Business Budgeting and Budgetary Control—The Law Book Co. of Australasia Pty Ltd.

Material	£1,450
Labour	300
Selling Expenses	570
Financial Expenses	130

On the other hand, Manufacturing Expense was £300 under budget and Administrative Expenses, £200 under. Instead of obtaining a profit of £10,235, therefore, the total actually made was £8,050. An analysis of the causes of the various increases and decreases would then be made by an inspection of cost records and it is suggested that the following reasons may be responsible:—

1. Losses on materials could be due to increased prices and excess waste due to carelessness and to inferior articles.
2. Labour costs may have been caused by increased awards.
3. Selling expense increases may also have been caused by higher awards or more travelling.
4. Savings in manufacturing expense may have been the result of greater efficiency and various economies.
5. Administrative expense savings may also have been due to economies effected.
6. The adjustment of stock item, £225, may have been due to pilferages, obsolescence, or reduction in values.

In connection with this last item it will be seen that whereas the stock should have been increased by £645 the actual additional amount was £420.

In analysing the foregoing it is necessary to bear in mind that there are really three sets of figures portrayed. Normal sales are first developed, actual sales, both at allowed costs and actual costs, are also shown, and thirdly, actual production is set forth. The difference between normal and allowed costs at actual turnover, shows the relative over-absorption or under-absorption of fixed costs or variations due to volume which are often uncontrollable variations. When the Profit and Loss Account is prepared it becomes possible to compare actual results against allowed costs based on actual turnover and any variations in this regard are, generally speaking, controllable.

It will be seen that the foregoing gives comprehensive information concerning the whole of the results and it is possible to ascertain, not only the differences in costs (and thereafter the reasons for them) but also the difference in profit due to changing the proportions of sales of Products A, B and C. It is admitted that there are few businesses which can be reduced to Products A, B and C, but the illustration given portrays the method of approach. The variation necessary in procedure depends upon the individual circumstances encountered in the business under review, and it is frequently possible to segregate manufactured products into groups, analysing results in relation to such.

FIGURE No. 99.

COMPARISON OF ACTUAL PROFITS WITH BUDGETED STANDARDS.

(a) BUDGETED STANDARDS.

BASED ON NORMAL CAPACITY.

Product " A "—£30,000. Product " B "—£30,000. Product " C "—£40,000.

Particulars	Fixed	% Variable	Standard % at Normal Capacity	Total %
Product " A "—				
Material		20	20	
Labour		18	18	
Manufacturing Expense	£750	5	7.5	45.5
Administrative Expense	600	2	4	
Selling Expense... ...	1200	7	11	15
Financial Expense ...	150	1	1.5	1.5
	£2700	53	62	62
Profit				38
			Sales ...	100
Product " B "—				
Material		18	18	
Labour		20	20	
Manufacturing Expense	£1200	6	10	48
Administrative Expense	600	2	4	
Selling Expense... ...	900	6	9	13
Financial Expense ...	150	1	1.5	1.5
	£2850	53	62.5	62.5
Profit				37.5
			Sales ...	100

FIGURE No. 99—*Continued.*

COMPARISON OF ACTUAL PROFITS WITH BUDGETED STANDARDS.

(a) BUDGETED STANDARDS.

BASED ON NORMAL CAPACITY.

Product " A "—£30,000. Product " B "—£30,000. Product " C "—£40,000.

Particulars	Fixed	% Variable	Standard % at Normal Capacity	Total %
Product " C "—				
Material		40	40	
Labour		20	20	
Manufacturing Expense	£1600	8	12	72
Administrative Expense	800	2	4	
Selling Expense... ...	2000	10	15	19
Financial Expense ...	800	2	4	4
	£5200	82	95	95
Profit				5
			Sales ...	100

COMBINED PRODUCTS " A," " B," AND " C."

Particulars	Fixed	% Variable	Standard % at Normal Capacity	Total %
Material		27.4	27.4	
Labour		18.8	19.4	
Manufacturing Expense	3,550	6.5	10.05	56.85
Administrative Expense	2,000	2.0	4.0	
Selling Expense... ...	4,100	7.9	12.0	16.0
Financial Expense ...	1,100	1.4	2.5	2.5
	10,750	64.0	75.35	75.35
Profit				24.65
			Sales ...	100

FIGURE NO 99—*Continued.*

(b) PROFITS ON FORECASTED AND ACTUAL RESULTS AT BUDGETED STANDARDS.

1. Forecasted Sales.

Product	Sales	Proportion %	% Profit	Amount of Profit
" A "	20,000	25	38	7,600
" B "	24,000	30	37½	9,000
" C "	36,000	45	5	1,800
	£80,000	100	23	£18,400

2. Profit at Standard Rates on Actual Sales and Production.

Product	Actual Sales	%	Actual Production	Change in Stock Total	Change in Stock Total at Standard Manfg. Cost	Profit .on Actual Sales at Standard Rate
" A "	15,000	25%	18,000	+ 3,000 (more)	+ £1,365 (more)	˙ £5,700
" B "	18,000	30%	12,000	− 6,000 (less)	− £2,880 (less)	£6,750
" C "	27,000	45%	30,000	+ 3,000 (more)	+ £2,160 (more)	£,1350
	£60,000	100%	£60,000	—	+ £645	£13,800

3. Variation in Manufacturing Expense.

Actual Production	At Standard Cost (Normal Capacity)	At Standard Rates	Variation
£18,000	× 7.5% = £1,350	× 5% = £900	
£12,000	× 10% = £1,200	× 6% = £720	
£30,000	× 12% = £3,600	× 8% = £2,400	
		Fixed Cost £3,550	
	£6,150	£7,570	£1,420

4. Variation in Selling Expense.

Actual Sales	At Standard Cost (Normal Capacity)	At Standard Rates	Variation
£15,000	× 11% = £1,650	× 7% = £1,050	
£18,000	× 9% = £1,620	× 6% = £1,080	
£27,000	× 15% = £4,050	× 10% = £2,700	
		Fixed £4,100	
	£7,320	£8,930	£1,610

FIGURE No. 99—*Continued*

(c) COMPARISON OF FORECASTED AND ACTUAL PROFITS.

Particulars	Standard Costs at Normal Capacity	Standard Costs On Actual Results	Volume Variations Normal Capacity and Forecasted Results	Actual Costs as per P. and L. Statement	Cost Variation Actual over Forecasted	Variation
Sales...	£60,000	£60,000		£60,000		
Material ... } Incurred at £60,000 Production	£17,040	£17,040		£18,500	£1.460	more than budget
Labour ...	£11,700	£11,700		£12,000	300	„ „ „
Manufacturing Exp. ...	£6,150	£7,570	£1,420	£7,270	300	less than budget
	£34.890	£36,310		£37,770	£1,460	
Less Increase in Stock ...	645	645		420	225	
Manufacturing Cost of Sales	£34,245	£35,665	£1,420	£37,350	£1,685	
Gross Profit	£25,755	£24,335		£22,650		
	£60,000	£60,000		£60,000		
Administrative Expenses...	£2,400	£3,200	£800	£3,000	£200	less than budget
Selling Expenses	£7,320	£8,930	£1,610	£9,500	570	more than budget
	£9.720	£12,130	£2,410	£12,500	£370	„ „ „
Financial Expenses ...	£1,575	£1,970	£395	£2,100	130	„ „ „
	£11.295	£14,100	£2,805	£14,600	£500	
Net Profit on Cost of Sales Basis	£14,460	£10,235	£4.225	£8,050	£2,185	less than budget
	£25,755	£24,335		£22,650		

FIGURE No. 99.—*Continued*

(c) COMPARISON OF FORECASTED AND ACTUAL PROFITS—*Continued.*

	Standard profit at Normal Capacity		£14,460
	Variations.		
Less	Losses Due to Manufacturing Volume	£1,420	
	Selling Volume		
	Selling Expenses	£1,610	
	Administrative Expenses	800	
	Financial Expenses	395	£4,225
	Standard Profit at Actual Results		£10,235
Less	Losses on Materials		
	(e.g., Purchases, Waste, etc.)	£1,460	
	Losses on Labour		
	(e.g., Increased Award Rates)	£300	
	Adjustment of Stock	£225	
	Increased Selling Expenses		
	(e.g., Increased Award Rates)	£570	
	Increased Financial Expenses		
	(e.g., Increased Interest Rate)	£130	£2,685
			£7,550
Plus	Savings in Manufacturing Expense	£300	
	(e.g., Various Economies)		
	Savings in Administrative Expense	£200	500
	(e.g., Various Economies)		
	Actual Net Profit		£8,050

CHAPTER 28.

PRINCIPLES OF ACCOUNTING CLASSIFICATION.

Advantages of Classification of Accounts.

A classification of accounts can be defined as a systematic arrangement of accounts designed to promote and develop functional relationships, the orderly recording of transactions, and adequate control of accounts.

The main advantages of an adequate classification may be set out as under:—

1. It provides a definition of functions which facilitates accurate and speedy recording of transactions.
2. It promotes the easy addition of new accounts and facilitates any other necessary changes.
3. It provides a guide and instruction to the recording staff.
4. It ensures an economy in clerical effort by the use of symbols.
5. It facilitates and promotes financial statements and accounting statistics, and provides clarity in relation thereto.
6. It provides an easy method of conveying information relating to accounting matters.

Preparation of Classification of Accounts.

For the successful prosecution of a cost accounting system the preparation of a suitable classification of accounts is one of the first considerations to which attention should be given. Apart from any other consideration, it is most important to see that each particular account represents one prime element only, otherwise confusion will almost certainly arise. Furthermore, an adequate classification will facilitate the preparation of costing data and costing statements.

The steps to be taken to change an existing classification into one more suited for the business can be set down as under:—

1. A thorough survey of all relevant factors relating to the business should be made, with a view to ascertaining how these would affect the classification of accounts and in what manner such factors could be best portrayed. Frequently a classification is a mirror of the transactions of the organisation, and as such should be capable of giving as clear a picture as possible.
2. The various financial statements of the organisation should be examined. If these are not in the most suitable form, attention must first be given to the alterations necessary to improve them. This applies particularly, of course, to the Balance Sheet and Trading and Profit & Loss Accounts. This is important because it may be

found that the best method of approaching the preparation of a new classification is on the basis of the Balance Sheet accounts.

3. Each account in the existing classification should be carefully studied so that the precise nature of the account is known and the expenditure which affects it is examined. Special attention should be paid to those accounts where there is more than one prime element posted.
4. The existing classification should then be altered to conform to the requirements as expressed through the final accounts. Starting off with the Balance Sheet, the various Asset accounts should first be covered and these should be followed by the liabilities. It is usually wise to cover these accounts with single symbols in the first place, and then work towards the divisions and sub-divisions of each single class.
5. When these have been completed and every effort has been made to see that each account is precisely named and includes at all times possible one prime element only, a trial of the system can be arranged by the preparation, firstly of the financial statements, and secondly of supporting schedules, which will bring the divisions and sub-divisions into play. An exercise of this kind will often show up any weaknesses.
6. When the classification is ready, the method of keeping the accounts must be decided upon and this will naturally include the types of ledgers and the subsidiary accounts.
7. The new classification should preferably be instituted at the beginning of a financial period, so as to prevent confusion in the drafting of final accounts at the end of such period. It is usually wise to keep a record of the relevant accounts in the new classification covering those in the old. This will often facilitate preparation of returns and statements relating to both the old and new periods and may also be valuable where it is desired to take out comparative statistics.

Alterations to Classification.

Whilst it is desirable to avoid continual alterations, it is usually found that a classification does require amendment from time to time. This may be because of changes in the business itself, variations in the types of assets and liabilities, the adoption of different trading methods, or excursions into new products. Where factors of this kind arise, it is far better to amend the classification, and thus retain a maximum utility value from it, rather than avoid amendments, simply from a desire to obviate changes.

Symbols.

The use of symbols has become a commonplace in business to-day. Their value is to be found in so many different avenues, and their advantages are so obvious that they are frequently used. When functioning in account classification, symbols may be defined as a combination of

figures and/or letters designed to specify or typify an account. The main types of symbol systems useful for account classifications are:—

1. *Alphabetic*—involving the use of a letter or a combination of letters (A, B, C, D or Aa, Bb, Cc, etc.)—

   e.g. A Cash.
   - Aa Cash at Bank
     - Aaa A. B. Bank
     - Aab C. D. Bank
     - Aac E. F. Bank
   - Ab Cash in Hand
   - Ac Petty Cash.

   B Accounts Receivable.
   - Ba Sundry Debtors
   - Bb Bills Receivable
   - Bc Deposits
   - Bd Special Trade Accounts.

2. *Numeric*—covering the use of a number or a combination of numbers—(1—11—111—1111)—

   e.g. 1 Cash
   - 11 Cash at Bank
     - 111 A. B. Bank
     - 112 C. D. Bank
     - 113 E. F. Bank
   - 12 Cash in Hand
   - 13 Petty Cash

   2 Accounts Receivable.
   - 21 Sundry Debtors
   - 22 Bills Receivable
   - 23 Deposits
   - 24 Special Trade Accounts

3. *Combination*—using both figures and letters (A124/B)—

   e.g. A Cash
   - A1 Cash at Bank
     - A11 A. B. Bank
     - A12 C D. Bank
     - A13 E. F. Bank
   - A2 Cash in Hand
   - A3 Petty Cash

   B Accounts Receivable
   - B1 Sundry Debtors
   - B2 Bills Receivable
   - B3 Deposits
   - B4 Special Trade Accounts

Alternatively combination of symbols may be used as follows :—

Assets	Liabilities
1. Current Assets	2. Current Liabilities
3. Investments	4. Other Liabilities
5. Land, Plant & Equipment	6. Reserves
7. Intangible Assets	8. Capital
9. Deferred Charges.	

Income & Expense Accounts.

A Material Costs
B Labour Costs
C Manufacturing Expenses
D Sales & Discounts
E Cost of Sales
F Selling & Administration Expenses
G Non-Operating Income & Expense.

The above would operate as under:—

1 Current Assets.

  11 Cash

    111 Cash at Bank
      1111 A. B. Bank
      1112 C. D. Bank
      1113 E. F. Bank
    112 Cash in Hand
    113 Petty Cash.

  12 Accounts Receivable.

    121 Sundry Debtors
    122 Bills Receivable
    123 Deposits
    124 Special Trade Accounts.

C Factory Expenses.

  C01 Depreciation
  C02 Building Repairs & Maintenance
  C03 Plant „ „ „
  C04 Toolroom „ „ „
  C05 Rates & Taxes
  C06 Power
  C07 Light
  C08 Heating
  C09 Water
  C10 Indirect Labour, etc.

Example of Classification.

In the following Chart of Accounts, it will be seen that the primary classification is in terms of Assets and Liabilities, with one item of Operating, viz.:—

1. Cash and Accounts Receivable.
2. Stocks
3. Other Current Assets.
4. Plant & Property.
5. Deferred Charges.
6. Current Liabilities.
7. Long Term Debts and Reserves.
8. Capital and Profit & Loss.
9. Operating.

This lends itself to easy sub-division and at the same time an easy building up of functional relationships by the addition of two digits within the classification, e.g.:—

1 Cash and Accounts Receivable.

  11 Cash at Banks
  12 Petty Cash
  13 Bills Receivable (Trade & General)
  14 Bills Receivable (Special)
  15 Sundry Debtors (Trade & General)
  16 Sundry Debtors (Special)

Again, there is ample scope for further division, e.g.:—

11 Cash at Banks—

  111 "A. B." Bank
  112 "C. D." Bank
  113 "E. F." Bank.

TYPICAL CHART OF ACCOUNTS.

General Ledger :

ASSETS :

1. *Cash and Sundry Debtors* :		11	Cash at Banks
		12	Petty Cash
		13	Bills Receivable (Trade and General)
		14	Bills Receivable (Special)
		15	Sundry Debtors (Trade)
		16	(Special and Adjustments)
	Less	17	Reserve for Bad & Doubtful Debts
		18	Reserve for Discounts & Special Allowances
2. *Stocks* :		211	Raw Material
		212	Work in Process
		213	Uncompleted Contracts
		214	Finished Product
		215	Expense Materials and Supplies
	Less	218	Payments on Unfinished Contracts
3. *Other Current Assets* :		311	Marketable Securities (In detail)
		312	Accrued Interest Receivable
		313	Other Prepayments
Total Current Assets :			
4. *Plant and Property* :		411	Land
		412	Buildings
		413	Machinery & Equipment (Plant)
		414	Motor Cars, Trucks, etc.
		415	Office Machinery & Equipment
		416	Furniture and Fittings
		417	Work in Construction (Unfinished)
	Less	420	Reserve for Depreciation of Buildings
		421	Reserve for Depreciation Machinery and Equipment
		422	Reserve for Depreciation of Office Machinery & Furniture & Fittings
Total Plant and Property :			
5. *Deferred Charges* :		511	Unexpired Insurance
		512	Taxes Paid in Advance
		513	Indirect Materials & Supplies Stocks
		514	Interest Paid in Advance
Total Assets :			

TYPICAL MODERN CHART OF ACCOUNTS.

LIABILITIES .

6. *Current Liabilities* :	611	Bills Payable
	612	Sundry Creditors (Trade)
	613	Sundry Creditors (Special)
	614	Taxes Accrued
	615	Accrued Pay Roll Account
	616	Pay Roll Tax Accrued
	617	Unaudited Liability Account
Total Current Liabilities :		
7. *Long Term Debts & Reserves* :	711	Debentures and Mortgages Payable
	712	Reserve for Contingencies
	713	Reserve for Stock Losses

Total Liabilities :

8. *Capital & Profit and Loss* :	811	Authorised Capital
	812	Unallotted Share Capital
	813	Uncalled Capital Account
	814	Application and Allotment Account
	815	Calls Account
	816	Calls in Advance Account
	817	Forfeited Shares Account
	818	Dividends Account
	819	Profit and Loss Account
	820	General Reserve
	821	Profit & Loss Appropriation Account
9. *Operating* :	911	Manufacturing Expense
	912	Administrative Expense
	913	Warehouse Expense
	914	Selling Expense
	915	Miscellaneous Income
	916	Miscellaneous Expense
	917	Variations from Standard
	918	Unabsorbed Burden
	919	Sales
	920	Sales Returned
	921	Deductions from Sales
	922	Cost of Goods Sold

It will be seen from the foregoing that an orderly arrangement is possible at the outset, major groups numbered 1 to 3 covering Current Assets, 4 Fixed Assets, 5 Deferred Charges, 1 to 5 Total Assets, 6 Current Liabilities, 7 Fixed Liabilities, 6 to 7 Total Liabilities (other than Capital), 8 Shareholders' Funds and 9 Operating.

As indicated previously further subdivision is easily arranged. Before deciding upon the subdivision, however, careful attention should be given to all those factors relating to the main account. The following notes on accounts will help to clarify this position. For example, an analysis may be made of:—

Number 211—Raw Material.

This is capable of a great deal of sub-division. Probably, however, there would be a separate stores classification system, which would be prepared in connection with Stock and Bin Cards and general Materials records.

Number 212—Work in Process.

One of the most difficult problems is the Control of Work in Process Accounts. This may be achieved in the following manner, involving a keen analysis of each individual concern and a clear conception as to the separation of:—

1. Material.
2. Labour.
3. Expense.

A further examination may be necessary to decide whether these elements of cost may further be embraced by Product Classes, so as to promote a logical determination of profits by Product Classes, rather than by some other means which would provide the management with little information of value. Work in Process could be handled in the following ways:—

1. Material, Labour and Expense by Department.
2. Material by Material Class, and Labour and Expense by Department.
3. Material, Labour and Expense by Product Class.

Decisions of this nature must inevitably be made very early in the process of any Cost Installation and must then be incorporated in the Classification of Accounts, e.g.:—

212	Work in Process—	
	2121	Material
	2122	Labour
	2123	Expense,
		or, alternatively,
	2121	Ice Cream
	2122	Lika Cream
	2123	Packets
	2124	Blocks
	2125	Cakes
	2126	Squares.

Account No. 214—Finished Stock.

It may be necessary to create an altogether different classification of code numbers of Finished Stock, from those established during the course of production. The cause of this could be the interchangeability of parts in the assembly of finished stock. If Product Classes in production conform strictly to the finished article, the retention of Product Classes is desirable, but the change from production to finished stock may mean that the Finished Stock Inventory must be strictly related to the physical unit. In account 212, for example, there may be a subdivision of Finished Stock according to Product Classes, viz :—

2141	Ice Cream
2142	Lika Cream
2143	Packets
2144	Blocks
2145	Cakes
2146	Squares.

Account No. 215—Expense Materials and Supplies.

This absorption of such materials is reflected in expense statements, drawn up through transfers from the appropriate stores, and therefore needs no code classification.

Number 4—Plant and Property.

This subdivision of the Classification of Accounts is capable of extensive analysis, both manually and mechanically, particularly when it is essential to obtain individual expense-rates within departments, and still adhere to the fundamental principle of control through the General Ledger. It also affords a basis for the application of maintenance costs to groups of machines, and the effect of these costs in relation to the efficiency, antiquity, and future life of the machines.

Cost centres within Departments and the use of such for spreading expense scientifically, create cost refinements which give accuracy in apportionments and cost-finding factors which are essential in modern economic competition. Subsidiary records can be kept though these usually take the form of a Plant Ledger.

4.	Plant and Property—
4131	Foundations
4132	Services
4133	Foundry Equipment
4134	Sheet Metal
4135	Machine Shop Plant
4136	Loose Tools.
41321	Electric Mains, Wiring etc.
41322	Air Lines
41323	Power
41324	Heating
41325	Lighting
413241	Electric Heaters
413242	Gas Heaters
413243	Coke Heaters.

Obviously sub-classifications can be extended almost indefinitely, but where the symbols become too long through a large number of digits, accurate recording may suffer. Mechanical means (particularly punched card equipment) will, however, facilitate handling such symbols.

No. 9—Operating.

This description is general only until it is converted into the following classification:—

911	Manufacturing Expense
912	Administrative Expense
913	Warehouse Expense
914	Selling Expense
915	Miscellaneous Income
916	Miscellaneous Expense
917	Variation Accounts
918	Unabsorbed Expense—Manufacturing
919	Unabsorbed Expense—Selling
920	Sales
921	Sales Returned
922	Deductions from Sales
923	Cost of Goods Sold
924	Stock Adjustments.

The foregoing accounts are then capable of further subdivision.

Sometimes with a number of departments, it becomes necessary to specify the departments and then to symbolize the functions. In the following list, a number of accounts are included which are relevant to a number of bonus plans based upon the point system (or payments made upon time and effort) with allowances for inadequate processing and base rates in relation to age and performance. These can then be applied to various departments affected by the addition of the departmental symbol.

TYPICAL MODERN CHART OF ACCOUNTS.

01	Managerial
02	Executive Salaries
03	Salaries Salesmen
04	Planning and Budgeting
05	Supervision
06	Foremen and Assistants
07	Mechanics and Machine Fixers
08	Material Handling
09	Indirect Labour—General
10	Idle Time Allowed—Bonus Plan
11	Allowance to Equal Standard—Bonus Plan
12	Base Rate Excess Cost—Bonus Plan
13	Process Allowance—Bonus Plan
14	Bonus Plan Costs
15	Overtime Allowance
16	Shift Allowance
17	Paid Holidays
18	Sick Pay

For convenience of analysis it may be considered that as the above in essence represent direct payroll items, space may be left for additional accounts, with the remaining following in alphabetical order:

30	Advertising—Booklets and Folders
31	Advertising—Display
32	Advertising—Newspaper
33	Advertising—Screen and Radio
34	Advertising—Sundry
35	Audit Fees
36	Bad and Doubtful Debts
37	Bulk Store Costs
38	Commission Account
39	Cost of Idleness
40	Credit and Collections
41	Developmental
42	Directors Fees
43	Exchange and Bank Charges
44	Expense Materials and Supplies
45	Insurance—Workers Compensation
46	Laboratory
47	Legal Expense
48	Maintenance and Repairs—Buildings
49	Maintenance and Repairs—Machinery and Equipment
50	Packing and Shipping Supplies
51	Pay Roll Tax
52	Postage, Telephone and Telegraph
53	Power Light Heat and Water
54	Printing, Stationery, Office Supplies
55	Rentals
56	Research and Experimental
57	Royalties
58	Samples
59	Tabulating Machine Costs
60	Trade Fees and Subscriptions
61	Travelling and Entertaining
62	Watchmen, Yardmen, Sweepers, Cleaners
63	Welfare
80	Miscellaneous

A space is now provided for the possibility and desirability of carrying fixed charges as a separate entity.

90	Depreciation
91	Insurance
92	Rates and Taxes

As indicated, the above accounts are common to Accounts numbered:—

911	Manufacturing Expense
912	Administrative Expense
913	Warehouse Expense
914	Selling Expense.

In this Chart of Accounts, Operating is classified under 9 and all that is required is the appropriate suffix to bring them into action. Thus Printing and Stationery used in connection with each of the foregoing would be:—

91154	Printing and Stationery Manufacturing Expense
91254	Printing and Stationery Administrative Expense
91354	Printing and Stationery Warehouse Expense
91355	Printing and Stationery Selling Expense.

An analysis of 915 Miscellaneous Income can be done in the following manner:—

91501	Dividends Received
91502	Interest Earned on Investments
91503	Cash Discounts Received
91504	Gain or Loss on Sales of Capital Assets
91505	Gain or Loss on Sales of Investments
91506	Income from Non-Operative Properties
91507	Gain or Loss on Cafeteria Operation
91508	Other Income

916 Miscellaneous Expense can be covered as under:—

91601	Sundry Interest Accrued
91602	Provision for Income Tax
91603	Expenses on Non-Operating Properties
91604	Other Expenses

thus preserving the integrity of the Controlling Accounting System in relation to a complete tie-up with the General Ledger.

The technique of establishing Variation Accounts in a comprehensive system of Budgetary Control and Standard Costs has already been discussed in detail in Chapters devoted to these subjects. These accounts can also be shown.

The major classification is 9, with the sub-classification of:—

917	Variations from Standard, and further divisions—
91701	Material Price Variation
91702	Material Usage Variation
91703	Labour Variation
91704	Expense Variation
91705	Selling Expense Variation.

all of which are controlled by the General Ledger. The variations embodied (in total) in the following two accounts are most important from a management angle, as they represent factors which should be studied.

918	Unabsorbed Account—Manufacturing
919	Unabsorbed Account—Selling.

A scientific classification of Accounts in relation to Sales is invaluable, particularly as it is so often desirable to analyse all sales classifications into profit or loss studies. The major control is:—

920	Sales,

which expressed in the terms of an entrepreneur of wholesale products of hardware would be:—

92001	Miscellaneous Hardware
92002	Radio
92003	Ammunition
92004	Cutlery
92005	Automotive,

or in terms of a textile manufacturing organisation:—

92001	Silk Garments
92002	Rayon Garments
92003	Silk and Woollen Garments
92004	Cotton Garments
92005	Woollen Garments.

In the organisation of the accounting procedure, with an eye on future possibilities, speed is the essence of the problem, particularly in relation to the early comparison of actual performance with the budgeted programme. The above classification lends itself to speedy treatment.

921 Sales Returned.

This could embody a sub-classification embracing the causes of these returns, and the amounts involved, thus exercising an accounting control over the item.

In making up the monthly Income Statement, another control is used, i.e.,

922 Deductions from Sales

An automatic breakdown can be used to disclose the character of these deductions, without a complicated analysis through expense accounts. They may be expressed as follows:—

92201	Allowances
92202	Provision for Discounts
92203	Freight and Cartage on Sales
92204	Inward Freight and Cartage on Sales

The final gross profit results can be interpreted through:—

923 Cost of Goods Sold.

This again is broken down into the relevant sales accounts, or product classes, consistent with the character and operations of the organisation.

Situations invariably arise during the currency of financial periods involving adjustments between stock accounts, and work in process accounts and the cost of goods sold accounts. Provision is therefore made for:—

924 Stock Adjustments

This account, however, should be subject to strict supervision in relation to the operation of the Budgetary Control and Standard Cost Procedure.

The idea behind this Classification of Accounts is that all subsidiary analysis should be carried out by ring binder ledgers. These give speed in the operations by facilitating a broad distribution of work embracing the number of standard journal entries which must be compiled rapidly, so that the Monthly Income Statements for the directorate become available early. This distribution is made through the General Accounting Section and the Cost Department, each sectional executive being responsible for his own series of journal entries.

Internal requisitions would be shown on the appropriate analysis sheets, which would then form the basis for each monthly Journal Voucher, indicating in the case of materials for example, the consumption for the month.

In the case of expense, standard printed forms could be used extensively to cover:—

1. Manufacturing Expense.
2. Administrative Expense.
3. Selling Expense.

Separate columns can be provided for budget actual and variations.

The following is a Classification suitable for use in a textile concern:—

General Ledger :

ASSETS :

A. *Cash and Accounts Receivable* :		A 1	Cash at Banks
		2	Petty Cash
		3	Bills Receivable (Trade & General)
		4	Bills Receivable (Special)
		5	Sundry Debtors (Trade)
		6	Sundry Debtors (Special and Adjustments)
	Less	12	Reserve for Bad & Doubtful Debts
		13	Reserve for Discounts & Special Allowances
B. *Stocks* :		B 1	Raw Material
		2	Work in Process
		3	Finished Product
		4	Expense Materials & Supplies
	Less	10	Reserve for Inventory Adjustments
C. *Other Current Assets* :		C 1	Marketable Securities (in detail)
		2	Accrued Interest Receivable
		3	Other Current Assets
Total Current Assets :			
D. *Plant & Property* :		D 1	Land
		2	Buildings
		3	Machinery & Equipment (Plant)
		4	Lorries and Cars
		5	Office Machinery & Equipment
		6	Furniture & Fittings
		7	Work in Construction (Unfinished)
	Less	15	Reserve for Depreciation—Buildings
		16	Reserve for Depreciation—Machinery and Equipment
		17	Reserve for Depreciation—Automobiles, Office Machinery, Furniture & Fittings.
Total Plant and Property :			
E. *Deferred Charges* :		E 1	Unexpired Insurance
		2	Taxes Paid in Advance
		3	Indirect Materials & Supplies Stocks
		4	Interest Paid in Advance

Total Assets :		
LIABILITIES :		
F. *Current Liabilities* :	F 1	Bank
	2	Bills Payable
	3	Sundry Creditors (Trade)
	4	Sundry Creditors (Special)
	5	Taxes Accrued
	6	Accrued Pay Roll Account
	7	Pay Roll Tax Accrued
	8	Other Liabilities
	9	Unaudited Liability Account.
Total Current Liabilities :		
G. *Long Term Debts & Reserves* :	G 1	Debentures & Mortgages Payable
	2	Reserve for Contingencies
	3	Reserve for Stock Losses
Total Liabilities :		
H. *Capital & Surplus* :	H 1	Authorised Capital
	2	Unallotted Share Capital
	3	Uncalled Capital
	4	Application & Allotment Account
	5	Calls Account
	6	Calls in Advance Account
	7	Forfeited Shares Account
	8	Dividends Account
	9	Profit & Loss Account
	10	General Reserve
	11	Profit & Loss Appropriation Account
K. *Operating* :	K 1	Manufacturing Expense
	2	Administrative Expense
	3	Warehouse Expense
	4	Selling Expense
	5	Miscellaneous Income
	6	Miscellaneous Expense
	7	Variations from Standard
	8	Unabsorbed Burden
	9	Sales
	10	Sales Returned
	11	Deductions from Sales
	12	Cost of Goods Sold

Sub-classifications would appear as under:—

110 Basic Raw Materials—
  111 Wool
  112 Cotton
  113 Rayon
  114 Silk

120 Complementary Raw Material
  121 Pocketings
  122 Thread
  123 Buttons
  124 Trimmings
  125 Papers, Boxes

B Stocks—B2 Work in Process.

This is frequently a problem which must receive special treatment and consideration. The main methods of handling Work in Process are:—

(1) Material, Labour, & Burden by Department.
(2) Material by Material Class, & Labour & Burden by Department.
(3) Material, Labour & Burden by Product Class.

These can be covered by three different methods:—

ILLUSTRATION No. 1.

210 Work in Process by Department—
- 211 Knitting
- 212 Cutting
- 213 Machining
- 214 Finishing

ILLUSTRATION No. 2.

210 Work in Process by Material Class, Labour & Burden by Department—
- 211 Woollen Garments (Material)
- 212 Cotton Garments (Material)
- 213 Silk Garments (Material)
- 214 Rayon Garments (Material)
- 215 Labour & Expense (Knitting)
- 216 Labour & Expense (Cutting)
- 217 Labour & Expense (Machining)
- 218 Labour & Expense (Finishing)

ILLUSTRATION No. 3.

210 Work in Process by Product Class—
- 211 Womens Wear
- 212 Mens Wear
- 213 Childrens Wear

B. *Stocks*—B3 *Finished Product*—

310 Finished Product—
- 311 Womens Wear
- 312 Mens Wear
- 313 Childrens Wear

These records may be kept on a system of perpetual inventory and are readily adaptable to a Punched Card operation.

B. *Stocks*—B4 *Expense Materials and Supplies*—

410 Indirect Supplies—
- 411 Machine Parts
- 412 Cleaning Materials
- 413 Miscellaneous

D. Plant and Property.

The first six major accounts in this sub-division are controlled through a manual Plant and Equipment Ledger, or introduced into an installation by adapting the detail to punched card equipment. On account of the number of items embracing each sub-account it would be necessary to introduce a special code on a departmental basis, using the first digit to indicate the character of the asset and the second for the departmental number. This can be illustrated as under, assuming that it is proposed to code Machinery and Equipment.

31001 Cutting Department
32001 Machining Department
33001 Finishing Department

The classifications E, F, G and H require little further explanation as they fall readily within the conditions and principles already explained.

K. Operating.

The first four categories in Section K, embracing the expense of the organisation, are subject to the following accounting classification, which does not come into operation until it is prefixed by its controlling digit in the General Ledger. For example Executive Salaries are known as account number 02 in the classification, and the operation of the code can therefore be illustrated as under:—

102 will be Executive Salaries Manufacturing
202 will be Executive Salaries Administrative Expense
302 will be Executive Salaries Warehouse Expense
402 will be Executive Salaries Selling Expense

The accounts themselves can be classified as follows:—

01	Managerial
02	Executive Salaries
03	Salaries Salesmen
04	Planning and Budgeting
05	Salaries Clerical
06	Salaries Warehouse
07	Supervision
08	Foremen and Assistants
09	Machine Fixers
10	Material Handling
11	Indirect Labour
12	Idle Time Allowed—Bonus Plan
13	Allowance to Equal Standard
14	Base Rate Excess Cost
15	Process Allowance
16	Cost of Bonus Plan
17	Overtime Allowance
18	Shift Allowance
19	Paid Holidays
20	Sick Pay
49	Research and Experimental
50	Royalties
51	Samples
52	Steam
53	Tabulating Machine Costs
54	Trade Fees and Subscriptions
55	Transportation
56	Travelling and Entertaining
57	Watchmen, Yardmen, Cleaners, Sweepers
58	Welfare
69	Miscellaneous

Modern practice now favours the segregation of fixed charges, to reduce the effort in the transition of these amounts through expense statements. Fixed charges can therefore be kept separate, as e.g.:—

70	Depreciation
71	Insurance
72	Rates and Taxes

5 Miscellaneous Income—

501	Dividends Received
502	Interest Earned on Investments
503	Cash Discounts Received
504	Gain or Loss on Sales of Investments
505	Gain or Loss on Sales of Capital Assets
506	Income from Other Properties
507	Gain or Loss on Cafeteria
508	Other Income

6 Miscellaneous Expense—

601	Interest Accrued
602	Expenses on Other Properties
603	Other Expenses

7 Variations from Budget—

701	Material Price
702	Material Usage
703	Labour
704	Expense
705	Selling Expense

8 Unabsorbed Burden—

801	Manufacturing
802	Selling

9 Sales—

It is assumed that it is desirable to control the sales of the organisatio by Product Class. Following in logical order would be :—

901	Womens Garments
902	Mens Garments
903	Childrens Garments

10 Sales Returned—

1001	Womens Garments
1002	Mens Garments
1003	Childrens Garments

The above order is observed to segregate accounts emanating from th payroll from those comprising the rest of the classification, which can be expressed in alphabetical order :—

21	Advertising—Display
22	Advertising—Folders and Booklets
23	Advertising—Newspaper
24	Advertising—Screen and Radio
25	Advertising—Sundry
26	Audit Fees
27	Bad and Doubtful Debts
28	Bulk Store Costs
29	Commission Account
30	Cost of Idleness
31	Credit and Collections
32	Developmental
33	Directors Fees
34	Exchange and Bank Charges
35	Freight and Cartage on Sales
36	Indirect Supplies
37	Insurance—Workers Compensation
38	Laboratory
39	Legal Expenses
40	Maintenance & Repairs—Buildings
41	Maintenance & Repairs—Machinery & Equipment
42	Needles
43	Packing and Shipping Supplies
44	Pay Roll Tax
45	Postage, Telephone and Telegraph
46	Power, Light, Heat and Water
47	Printing, Stationery, Office Supplies
48	Rentals

11 Deductions from Sales

1101	Allowances
1102	Provision for Discounts
1103	Freight and Cartage on Sales
1104	Inward Freight and Cartage on Sales

12 Cost of Goods Sold

1201	Womens Garments
1202	Mens Garments
1203	Childrens Garments

The following classification is typical of the type appropriate to an engineering establishment.

PROVIDING FOR RATIO ANALYSIS.

General Ledger :

		ASSETS
A. *Cash and AccountsReceivable* :	A 1	Cash
	2	Bills Receivable
	3	Accounts Receivable—General
	4	Reserve for Bad and Doubtful Debts
	5	A.B. Banking Company
	6	Deposits on Contracts
B. *Stocks* :	B 13	Manufactured Raw Materials Control Account
	14	Purchased Materials Control Account
	15	Work in Process Control Account
	16	Castings Control Account
	17	Parts Control Account
	18	Goods on Consignment
	19	Finished Stock Control Account
C. *Prepayments* :	C 30	Insurance
	31	Advertising
	32	Rates and Taxes
	33	Fees and Subscriptions
	34	Telephone
Total Current Assets :		
D. *Fixed Assets* :	D 36	Land--Freehold
	37	Buildings (Including Cottages)
	38	Plant and Machinery
	39	Auxiliary Equipment
	40	Tools, Jigs and Fittings
	41	Patterns
	42	Furniture, Fittings and Office Equipment
	43	Work in Construction Account
	44	Reserve for Depreciation
Total Fixed Assets :		
E. *Intangible Assets* :	E 48	Patent Rights and Development
Total Assets :		
		LIABILITIES :
F. *Bills and Accounts Payable* :	F 50	Bills Payable
	51	Accounts Payable—General
	52	Accrued Payroll
	53	Unclaimed Dividends Account
	54	Sundry Accrued Liabilities
Current Liabilities :		
G. *Reserves* :	G 65	Reserve for Contingencies
	66	Special Stock Reserve
	67	General Reserve
J. *Capital and Surplus* :	H 70	Nominal Capital
	71	Unissued Capital
	72	Issued Capital
	73	Allotment and Calls Account
	74	Calls in Arrears Account
	75	Calls in Advance Account
	76	Forfeited Shares Account
	77	Dividends Account
	78	Profit and Loss Account
	79	Profit and Loss Appropriation Account
	80	Manufacturing Account
	81	Trading Account

INCOME EXPENSE AND VARIATION CONTROLLING ACCOUNTS.

100 ACCOUNTS.

Account No.	
101	Sales Account (Controlling Account)
102	Sales Returned Account
103	Freight and Cartage on Sales
104	Cost of Goods Sold (Controlling Account)
105	Stock Adjustments Account
106	Manufacturing Expense Control Account
107	Administrative Expense Control Account
108	Selling Expense Control Account
109	Variation Account—Material
110	Variation Account—Labour
111	Variation Account—Burden
112	Unabsorbed Burden Account
113	Miscellaneous Income Earned
114	Interest on Investments
115	Cash Discounts Received
116	Bad Debts Recovered
117	Gain or Loss on Sale of Capital Assets
118	Cash Discounts on Sales
119	Expenses on Non-operating Properties
120	Provision for Income Tax
121	Gain or Loss on Cafeteria Operation
122	Unaudited Liability Account

WORK IN PROCESS ACCOUNTS.

200 ACCOUNTS.

Account No.	
201	Pattern Shop
202	Foundry
203	Blacksmiths
204	Machine Shop
205	Fitters Assembly
206	Sheet Metal
207	Tool Room
208	Heat Treatment

MANUFACTURING EXPENSE.

300 ACCOUNTS.

Account No.		
301	F	Salaries—Supervision
302	F	Salaries—Planning
303	F	Salaries—Foremen
304	F	Salaries—Clerical
305	F	Salaries—Design
306	F	Salaries—Inventory Expense
307	F	Watchmen
308	F	Depreciation
309	F	Rates and Taxes
310	F	Insurance
311	F	Power, Light, Heat and Water
312	V	Assistant Foremen
313	V	Inspection
314	V	Bonus Account
315	V	Material Handling
316	V	Materials and Supplies
317	V	Reclamation Labour
318	V	Labour on Spoilage
319	V	Spoilt Material
320	V	Setting up Cost
321	V	Cost of Idleness
322	V	Overtime
323	V	Paid Holidays
324	V	Welfare
325	V	Indirect Labour (Other than Foundry)
326	V	Maintenance & Repairs—Buildings
327	V	Maintenance & Repairs—Machinery & Equipment
328	V	Maintenance & Repairs—Tools
329	V	Experimental
330	V	Laboratory
331	V	Postage, Telephone & Telegrams
332	V	Printing, Stationery & Office Supplies
333	V	Trade Fees and Subscriptions
334	V	General Foundry Labour
335	V	Developmental
336	V	Power, Light, Heat & Water
350	V	Miscellaneous

ADMINISTRATIVE EXPENSE.

400 ACCOUNTS.

Account No.		
401	F	Salaries
402	F	Patent Expenses
403	F	Directors Fees
404	F	Audit Fees
405	F	Cleaning and Sweeping
406	F	Depreciation
407	F	Rates and Taxes
408	F	Insurance
409	V	Postage
410	V	Telephone and Telegraph
411	V	Printing, Stationery & Office Supplies
412	V	Legal Expenses
413	V	Collection Expenses
414	V	Bad and Doubtful Debts
420	V	Miscellaneous

SELLING EXPENSE.

500 ACCOUNTS.

Account No.		
501	F	Salaries—Managerial
502	F	Salaries—Salesmen
503	F	Salaries—Service
504	F	Salaries—Packing & Shipping
505	F	Depreciation
506	F	Insurance
507	F	Rates and Taxes (Other than Sales Tax)
508	V	Commission
509	V	Travelling Expenses
510	V	Entertainment Expenses
511	V	Advertising
512	V	Exhibit and Show Expense
513	V	Servicing Expense
514	V	Packing & Shipping Supplies
515	V	Freight & Cartage
516	V	Printing, Stationery & Office Supplies
*517	V	Motor Vehicle Expense
518	V	Sales Tax
519	V	Postage, Telephone & Telegraph
520	V	Miscellaneous

*Subsidiary analysis on hourly or cost per mile basis.

SALES ACCOUNTS.

600 ACCOUNTS.

Account No.	
601	Sales Account
602	Sales Account
603	Sales Account
604	Sales Account
605	Sales Account
606	Sales Account
607	Sales Account
608	Sales Account
609	Sales Account
610	Sales Account
611	Sales Account
612	Sales Account
613	Sales Account
614	Sales Account

It is felt that the foregoing example should indicate the principles to be followed in preparing a Classification of Accounts. It should be stressed that too much care cannot be bestowed upon the preparation of a suitable classification as success in this regard can have a very great influence upon the clarity of accounting statements and statistical studies and the avoidance of confusion and ambiguity.

Accounts Manual.

When a Classification of Accounts has been completed, it is good practice to prepare an Accounts Manual which defines the account, states what it covers and tells briefly what should or should not be included. Such a preparation is extremely valuable, because of the following factors:——

1. It ensures a thorough acquaintance with each account.

2. It sets down in precise terms what the account covers.
3. It provides a ready reference for other than those dealing with the accounts directly.
4. It helps to acquaint a successor who has to take over the accounts.

A sample section of an Accounts Manual is shown hereunder :—

D—*Fixed Assets* :

D 37—Buildings (including Cottages):

(i) Covers cost of the factory, office and shop buildings and all cottages erected—including cost of engineering and architect services, excavations, foundations, filling in around foundations (not grading adjoining land) and transportation of materials.

(ii) Covers cost of initial installation of permanent appurtenances which are an integral part of buildings and necessary for the general purposes for which the buildings would ordinarily be used. These include :—

Power wiring from connections with main line systems to wall outlets.

Lighting wiring from connections with main line systems including lighting fixtures.

Plumbing and Toilet facilities.

Sewer and drain pipes from connections with main line systems.

Sprinkler and fire protection systems, including water storage tanks and piping for outside hose connections.

Heating systems, including boilers, furnaces and accessories installed within the building.

Ventilating systems, including blowers, motors and fans.

Elevators and motors and accessories.

Fire escapes.

Crane runways and wiring.

Does not include movable appurtenances such as :—

Wiring from wall outlets to machines, tools, benches etc. (Refer D 39).
Foundations for machinery (Refer D 38).
Air and gas piping (Refer D 39).

The actual degree of detail depends upon the individual circumstances of each organization and the complexity and character of the accounts.

CHAPTER 29.

DEPRECIATION AND AMORTISATION.

Whenever a machine is purchased for use in production, some decrease in value commences to operate as soon as the machine is used. Analysed fully, this really means that when a machine is used to turn out a product, some portion of the value of the machine passes into the product and should be recouped to the organisation by a charge included in the ultimate sales price. The exact amount to be charged is sometimes easy to calculate, but it is generally very difficult. Thus, if it was known that a machine costing £100 would turn out 100 products and no more, and at the end of that time would be valueless, obviously £1 should be allowed in the cost of each product turned out. Almost invariably, however, the position cannot be stated in such simple terms. In the first place, the number of products which will be turned out do not usually subscribe to a known number or to a single kind. Furthermore, all kinds of other factors intrude. Thus, if a machine is bought for £100 on 1st July, 1935, even though it was not used it would probably be worth very much less on 1st July, 1937. The decrease in value due to any cause of this nature is generally referred to as depreciation.

The term "Depreciation" used in this fashion actually covers a variety of factors which should be examined individually, because each may operate in somewhat different ways.

Definitions.

The following terms are used in connection with the study of this subject:—

Depreciation—is the loss of life or value of an asset due to wear and tear, use, abuse, exhaustion and the effects of the passage of time, and exposure to the elements. Alternatively, it may be described as that loss in service value which is not restored by current maintenance.

Obsolescence—is, briefly stated, the effect of factors which result in the asset being no longer able to serve in competitive fashion the purpose for which it was originally intended.

Inadequacy—denotes the inability of an asset to meet the productive demands for which it was originally procured.

Depletion—represents the decrease in value of an asset by the removal of some valuable material relating to it. The cutting of timber from a timbered area is an example.

Exhaustion—is similar to depletion, except that it usually relates to decline in re-productivity, such as the gradual lessening of soil fertility.

Supersession—represents the replacement of property which has outlived its usefulness because of some depreciation factors.

Amortisation—is the provision of amounts to cover a stated amount and is often effected by means of a sinking fund.

Repairs—usually describe the cost involved in keeping the asset in ordinarily efficient operating condition without adding to the value of the asset or appreciably prolonging its life.

Renewals—generally indicate expenditures incurred for the purpose of extending the life of the asset beyond the average life.

Residual Value—is the value of the asset after the allowance for depreciation, obsolescence etc. has been made.

Salvage or Scrap Value—is the value of the asset which might reasonably be realised from dismantling and selling the asset, either for some useful purpose or as junk.

Classes of Depreciation.

Many conditions may contribute to the decrease in value of an asset. They have been separated into three main divisions by Kester (Advanced Accounting, page 233). Figure No. 100 is taken from this book and sets forth the threefold division.

FIGURE No. 100

CLASSES OF DEPRECIATION.

A Tangible Property.
- 1. Physical
  - 1. Wear and Tear from Operation
    - (a) Maintenance Policy
  - 2. Decrepitude
    - (a) Action of Time and the Elements
- 11. Functional
  - 1. Inadequacy or Supersession
  - 2. Obsolescence
- 111. Contingent
  - 1. Accidents
    - (a) Negligence
    - (b) Elements
      - Fire
      - Lightning
      - Wind
      - Water
      - Temperature
    - (c) Structural Defects
  - 2. Diseases
    - (a) Parasites
    - (b) Pollution of Water
    - (c) Growths in Water Mains
      - Mineral
      - Vegetable
      - Animal
    - (d) Electrolysis
    - (e) Crystallization
  - 3. Diminution of Supply
    - (a) Natural Gas
    - (b) Water

1. *Physical Depreciation.*

This usually covers the decrease in value due to wear and tear, use, abuse and those general factors usually associated with "old age." Obviously these factors operate differently in the case of different assets, and even with like assets under differing conditions. Depletion and exhaustion come within this category of depreciation, as the effect is of a physical kind.

2. *Functional Depreciation.*

This covers such factors as Obsolescence and Inadequacy. Usually the asset reaches a stage where it is unable to perform the function for which it was intended, due either to inability within itself or to the operation of outside factors. Thus, where a new machine is able to do the work at a very much lower cost, the value of the old machine is decreased through functional depreciation.

3. *Contingent Depreciation.*

The nature of this type is suggested by the use of the word "contingent." Decrease in value may be due to structural defects, negligence, accidents or the effect of the elements. It is sometimes possible to insure against this type of depreciation.

Causes of Depreciation.

The following are causes of Depreciation:—

1. *Wear and Tear.*

This is the most usual cause of depreciation, and may arise from both mechanical and natural action. The actual use and operation of the plant and equipment may through vibration, friction and the general wearing of parts, result in mechanical action, which in turn results in depreciated value. Similarly, processes such as oxidation and crystallisation may result as natural actions in decreasing value. Usually repairs and perhaps renewals are made to retard the effect of wear and tear. The success which would attend such efforts, however, depends upon the type of asset affected. Thus, some assets such as heavy presses and lathes, are capable of being kept in operating conditions almost indefinitely by a good maintenance policy involving the replacement of bearings, etc. On the other hand, in the case of typewriters, for example, certain parts can be renewed, but there are so many small parts that a stage is reached where it is not worth while renewing so many parts and the whole asset is scrapped or "passed in."

2. *Obsolescence.*

This is usually brought about by such factors as changes in processes, more efficient machinery and new methods of production. These have the effect of making the assets obsolete. Thus a change in fashion may mean that machines capable only of turning out a product which was in fashionable demand, but now has lost favour, may well become obsolete. Furthermore, if a new machine can do a job very much better and at less cost than an old machine, the latter is usually referred to as being obsolete. When an asset reaches this stage and a new machine replaces it, supersession has taken place. The new machine has superseded the old. Obsolescence may occur through the inability of a machine to perform its functions satisfactorily or due to the product going out of favour.

Two further factors should be noted in connection with obsolescence:—

(a) It is sometimes advocated that separate allowances should be made for obsolescence on the one hand and all other items of depreciation on the other. Thus, if a machine costing £10,000 had a life of ten years, but a useful life of only four, it may be argued that £4,000 would be the depreciation chargeable to wear and tear and £6,000 to obsolescence. This treatment is, however, open to many objections.

(b) Some writers contend that obsolescence should be capitalized. Their argument rests upon the conclusion that where a machine is obsolete, another more efficient machine will be purchased. This will mean lower costs when the new machine begins to run. The obsolescent cost should therefore be held over until the lower costs are obtained and should then be written off during those periods. This, too, cannot be endorsed and indeed seems to rest upon the fallacy that new and more efficient machines will always be obtained where an old machine becomes obsolete.

3. *Inadequacy.*

When an asset becomes unable to fulfil either the demands made originally upon it or the demands resulting from a growing business, it may be termed inadequate. Here again the asset may be superseded. Frequently an organisation may commence with a small plant, but the stage may rapidly be reached where this plant has outlived its usefulness and a larger plant must be obtained. There is frequently a close relationship between obsolescence and inadequacy, but a distinction between these two is drawn in "Depreciation Principles and Application" by Saliers (Second Edition, page 26) :—

> "Let us assume the case of a machine which cost $10,000, has an estimated natural physical life of 10 years, and an estimated scrap value of $1,000. If the machine lives out its natural physical life, i.e., if neither obsolescence nor inadequacy causes it to be abandoned before it is worn out, it will be cared for by the usual method of setting up a depreciation reserve against which its costs less salvage is charged when abandoned. But there are two possible alternatives: First, the machine may, before the expiration of the tenth year, become incapable of performing the amount of work demanded of it because of an increase in that amount. Secondly, it may become unprofitable to continue using the machine because another could be purchased which would do the work equally well at a smaller cost per unit of output. Under the first assumption, the machine is inadequate; under the second assumption it is obsolete. It is easy to see that the factors or influences which give rise to the one are not the ones that give rise to the other."

Depending upon individual conditions, overtime may retard obsolescence but increase inadequacy. If the working life of a machine is 10 years, but it will become obsolescent in 8 years, obviously the obsolescent factor is the main one. If, however, two shifts are worked continuously, the working life of the machine may be reduced to five years, in which case it will be worn out before the obsolescent factor can operate. On the other hand, if continued overtime is worked, there is a probability of management deciding to buy a larger and more efficient machine because, with a larger production, the economy resulting from larger and more efficient machines will probably justify the change.

4. *Depletion.*

As explained in the definition of this term, usually this has relation to physical resources in connection with an asset. Thus, an organisation engaged in sawmilling may buy an area of land upon which large quantities of timber are growing. With the operation of the sawmill a commencement is made in cutting this timber. If, for the whole of the asset, a sum of £5,000 had been paid, and it had been calculated that the residual value of the land was £1,000, and the value of the timber £4,000, obviously when one quarter of the timber had been cut, the value of the asset would be £4,000. The difference of £1,000 would be due to depletion of the asset. The term is commonly met in such circumstances.

5. *Exhaustion.*

This operates similarly to depletion, but more in relation to such factors as soil fertility or water supply. For example, if an area of land is watered by wells, but over a period the wells gradually dry up, the value of the land may depreciate accordingly, so that when the wells have completely dried, the land may be of little value. The depreciating factor is thus due to exhaustion.

Factors Affecting Depreciation.

In giving consideration to the amount to be allowed as a provision for depreciation, a number of factors must be taken into account. These are:—

1. *The Extent and Use of the Asset in Production.*

This would include such questions as the number of shifts, during which the asset is used, the constancy of its use, and the conditions under which it is used. Because of special conditions, wear and tear may be very great. Vibration may be extreme. The conditions under which the plant operates may result in increased loss of value.

It was the demand for higher speeds and feeds which accelerated the search for improved cutting tools and high speed steels gave way to tungsten carbide in these tools. The benefits resulting from the use of tungsten carbide led, in turn, to an increased demand for still higher speeds and feeds, and thus the obsolescent factor has been increased where machines are not fully capable of taking full advantage of the improved cutting tools.

2. *The Repair Policy.*

This is a fundamental factor. If no provision is made for keeping the asset in constant repair the deteriorating effect may accumulate. The amount of depreciation to be allowed under conditions where little attention is given to repairs and renewals may be very much greater than where a careful and periodic check of all asset deficiencies is made with a view to restitution of value and utility. With some machines it is possible to keep them in use for an almost unlimited period by adequate maintenance. It should be noted, however, that adequate attention to maintenance may result in the retarding of some depreciation factors and not others. Thus, whilst it may offset wear and tear. it may have no effect upon obsolescence.

3. *Special Conditions.*

These may be classified as under:—

(a) Special liability to damage.
(b) Structural defects.
(c) Atmospheric conditions.
(d) Type of workmen.
(e) Nature and construction of the asset, together with its condition.
(f) Invention of new methods or machines, which may or may not entirely replace the old ones.
(g) Permanency of the business and production trends.
(h) Amounts previously written off for depreciation.
(i) Operating cost of the asset.

Effect of War Conditions.

Perhaps the operation of special conditions may best be considered in relation to the excess depreciation which often occurs in times of war, when the following factors may operate:—

1. The machine is often " Driven to Death," as production may be of paramount importance.
2. No time is available or alternatively, labour or materials are not available to carry out repairs.
3. Three shifts may necessitate the elimination of repairs.
4. Over the 24 hours, either two or three operators may be engaged, and each may leave even small repairs to the other.
5. Each of two or three operators may run a machine somewhat differently, and the effect may well be detrimental.
6. Either two or three shifts necessitate night-work, and the efficiency of a man on night work is usually lower than one on day work.
7. Dilutee labour must frequently be used, and abuse of the machine often results.
8. Incessant driving of a machine gives it no chance to rest, and it is a scientific fact that metal becomes fatigued.
9. Tolerances demanded of a machine are more exacting.
10. The machine may not be suitable or designed or adapted for the purpose to which it is put.
11. The machine may be asked to carry out work on much harder metals.
12. With the stimulation of inventions, machines may become obsolescent as soon as the war is over.

ACCOUNTING PROCEDURE.

Responsibility of Management.

Management must be interested in depreciation, because it is a matter of fundamental importance to a business. If no allowance is made, the business may find itself in the position that the original asset has lost all usefulness and yet there are no funds available for replacement because of negligence on the part of management in not seeing that the necessary amount of depreciation has been charged into the accounts. The following obligations may be said to rest upon management in relation to depreciation:—

1. To select a satisfactory method of dealing with the expense.
2. To decide upon the amount to be allowed.
3. To see that this amount is charged into costs.
4. To ensure where necessary that finance is set aside to replace the asset.
5. To take note of and meet the provisions of Income Tax Law.
6. To delegate responsibility for depreciation factors.
7. To provide for plant valuation and appraisals where necessary.
8. To see that the necessary records are kept.

Management frequently fails in its obligations in respect of depreciation particularly along the following lines:—

1. The amount of depreciation allowed is quite inadequate, is based on immature study, or is charged inconsistently.
2. Poor maintenance programmes upset the values allowed for depreciation.
3. No consideration is given to special factors, such as obsolescence.
4. No clear conception of what depreciation should cover governs the rates applied.
5. No precautions are taken to ensure that finance is available through a sinking fund, to provide for the renewal of worn out assets.
6. No clear conception operates in relation to the distinction between capital and revenue expense.
7. Depreciation is not calculated in costs in adequate fashion.
8. Depreciation factors are poorly recorded, and no asset register is maintained.

Before proceeding to a study of the accounting methods in use, a clear conception should be obtained as to exactly what depreciation is meant to cover. This may be:—

1. *Cost Less Scrap Value.*

In this case the amount allowed for depreciation would cover such sums that, at the end of the life of the asset, the value recouped to the business through depreciation charges will equal the value of that asset. Thus, if the cost price of an asset is £1,000, and its life is 10 years, the depreciation charged would be £100 per year. There may, of course, be some refinement of this. Thus, if there was a salvage value of £100 at the end of 10 years, it would be necessary to charge only £90 per year. Whilst the method of arriving at an annual charge for depreciation may vary, this is usually the fundamental principle underlying the depreciation charge.

2. *Cost of Replacement.*

It may be argued that the important factor in depreciation is not to see that at the end of the life of an asset the total charges for depreciation cover the cost of that asset, but rather that amounts thus set aside will be sufficient to replace the asset. This is a fundamental difference. If there was no change in the cost of the new asset and the old, the two methods would be the same. This rarely happens, however, partly because of fluctuations in the value of money, and partly because differences in technique may make for different manufacturing conditions. Thus, if a machine with a life of 10 years, cost £1,000, in 1930, and the same machine cost £1,500 in 1940, under the same replacement method (and with no salvage value), the amount to be provided would be £150 per year. If, however, the cost of the machine had dropped to £750 in 1940, obviously only £75 per year would have to be provided.

In connection with the replacement value, however, two factors must be taken into account. Firstly, the obvious difficulty in arriving at what this will be. It is frequently impossible to predict changes in the price level or differences in cost due to manufacturing technique changes. This is particularly so where assets have a long life. Secondly, if a business in 1930 required 10 machines each worth £1,000, the capital required for the 10 machines would obviously be £10,000. If these machines wore out in 1940 and had to be replaced at £1,500 each, the capital required would be £15,000. Only £10,000 would have been provided through depreciation. The question at issue would be whether the depreciation charged into costs should have been £15,000, or whether the business has been recouped its original capital value in the machines, viz., £10,000, and the other £5,000 should be provided by additional capital. The latter is the common approach, though frequently an organisation endeavours to avoid asking for more capital from the market by taking note of such factors and providing for certain reserves out of profits. It should be noted, however, that in such cases, the extra charge is one against profits, and not into costs.

The arguments in favour and against replacement cost may be summarised as under:—

In Favour:—

1. Depreciation should be based on replacement so that the plant can carry on as a physical producing entity without calling on new capital.
2. The cost of replacement finds its way into current costs and if the machine was bought during the current period, this would be the figure automatically included in consumer cost.
3. Replacement cost enters into so many management functions.

Against:—

1. The function of depreciation is to depreciate an asset—not to finance replacements.
2. Replacement cost may not be known with certainty (it rarely would be) and this may involve constant adjustments and changes of rates.

3. *Cost plus Maintenance.*

Depreciation and maintenance are closely related costs and any distinction drawn between them is arbitrary. Therefore it is contended that it is wise to estimate both, combine them, and write this total figure off over the acceptable period. The best answer to this contention appears to be that it is always extremely difficult to estimate depreciation without attempting the added difficulty of estimating maintenance charges over, possibly, a long period.

4. *Appraisal.*

Sometimes it is practicable to arrange for periodical appraisal of an asset and use the figure given for calculation of depreciation. This method is practicable only in relatively few cases, though it is sometimes used to obtain the value of such assets as consumable tools.

In carrying out an appraisal, a study is usually made of the following factors:—

(a) The purpose for which the asset is used, together with any other possibilities for use
(b) The physical lay-out of the asset.
(c) The design of the asset compared with latest designs.
(d) Location with reference to markets, materials and transportation facilities,

Methods of Depreciation.

Methods of providing depreciation conform to one of the following three divisions:—

1. *Proportional Methods.*

The main methods under this heading are:—

(a) Straight Line.
(b) Working or Machine Hours.
(c) Output.

(a) *Straight Line Depreciation.*

This is a simple method and consists of estimating:—

1. The life of the asset.
2. The ultimate residual value.

By dividing the difference between the original cost and the ultimate value by the number of years' life, the amount chargeable each year is obtained. Thus, a machine has an estimated life of 10 years, its cost is £10,000, its residual value is £1,000. The amount of depreciation charged each year would be £900 under the straight line method. As each year went by £900 would be added to the depreciation reserve, so that at the end of the 10 years, £9,000 would be thus set aside, and this, together with £1,000 which should be obtained as the residual value of the machine, would recoup the full £10,000 to the business. The straight line method is simple to operate and to record, and is the most commonly favoured method because of these factors. It is even more favoured in America than in Australia, as will be seen in later statistics.

The main objection to the straight line method is that it is too rigid—it does not allow of any adjustment in relation to differing periods of activity. The same amount is charged in the slack as the busy period. It ignores the fact that there should be a greater provision in those periods when there is a greater call on the asset. As against this, it is argued that if this method is followed, an attempt should be made to adopt a service unit measure. Again it is said that actually depreciation often bears no relationship to work done. Furthermore this contention sounds like expressing depreciation in terms of profit—"Keep down the charge in poor years and increase it in good ones."

(b) *Working or Machine Hours.*

Under this method the residual value is again calculated, but the life of the asset is expressed in terms of working hours, as for example, machine hours. Thus, a machine might cost £10,000, and its residual value be £1,000. It is calculated that there are 18,000 hours' life in the machine. This would mean that depreciation at the rate of 10/- per hour must be provided so that at the end of that period £9,000 depreciation would have been provided, and with the residual value, the full cost of the machine would have been recouped. The 18,000 hours may be worked in anything from four years upwards, and in this regard it differs from the straight line method. Furthermore, whilst under the straight line method the amount charged each year is irrespective of the use of the machine, under the working hours rates, only that depreciation actually applicable to a particular year is charged. This makes for greater accuracy, but it is probable that the straight line method is a better insurance against some depreciation factors, such as obsolescence. In the case of the machine hour rate method of factory expense, the calculation of depreciation under the working hour method is simple and easily calculated.

(c) *Output Method.*

This is often used in connection with assets which are depreciated through depletion. Thus, if the area of timbered land referred to earlier in this connection, which cost £5,000, of which £1,000 was for the land, and £4,000 for the timber, actually contained 4,000,000 super feet of timber, a calculation could be made of the charge which should be made for each 100 super feet of timber cut from the area. Timber royalties are calculated in this manner. Actually in the illustration given, £4,000 spread amongst 4,000,000 super feet would mean a charge of 2/- per 100 super feet of timber cut. The method is also used in connection with mines.

2. *Uniformly Diminishing Methods.*

These methods are based on the principle that the amount allowed diminishes year by year. The decrease is effected either through a reduction in the percentage rate, or a lowering of the basic value. If the percentage remains fixed, the base varies. If the base is constant, the percentage is reduced.

(a) *Diminishing Value.*

In this case the percentage is fixed, whilst the base varies. Thus, if the machine costs £10,000, and it is decided to allow a depreciation rate of 10% upon the diminishing value, the result would be as shown in Figure No. 101.

It will be noted from this method that it is impossible to reduce the value to nil. This does not matter so much where a residual value is involved, and it is desired to depreciate the asset down to the residual value.

FIGURE No. 101.

DEPRECIATION BY DIMINISHING VALUE METHOD.

First Year	10% of	£10,000	=	£1,000	0	0
		1,000				
Second Year	,, ,,	£ 9,000	=	£ 900	0	0
		900				
Third Year	,, ,,	£ 8,100	=	£ 810	0	0
		810				
Fourth Year	,, ,,	£ 7,290	=	£ 729	0	0
		729				
Fifth Year	,, ,,	£ 6,561	=	£ 656	2	0
		(say) 656				
Sixth Year	,, ,,	£ 5,905	=	£ 590	10	0
		(say) 590				
Seventh Year	,, ,,	£ 5,315	=	£ 531	10	0
		(say) 532				
Eighth Year	,, ,,	£ 4,783	=	£ 478	6	0
		(say) 478				
Ninth Year	,, ,,	£ 4,305	=	£ 430	10	0
		(say) 430				
Tenth Year	,, ,,	£ 3,875	=	£ 387	10	0
		(say) 388				
Value at end of Tenth Year		£ 3,487		£6,513	8	0
				(say) £6,513		

(b) *The Sum of Expected Life Period.*

In this case it is the percentage allowed year by year which alters, the base figure remaining unaltered. Thus, over a 10 year life, it is calculated that a machine would have a life term of 10, plus 9, plus 8, plus 7, plus 6, plus 5, plus 4, plus 3, plus 2, plus 1—equalling 55 years. In the first year, the depreciation rate would be 10/55ths, the next year 9/55ths and so on. Over the period this would work out as shown in Figure No. 102.

FIGURE NO. 102.

DEPRECIATION BY SUM OF EXPECTED LIFE PERIOD.

	Cost	*Depreciation Allowed*	*Residual Value*
First Year	$\frac{10}{55}$ of £9,000	£1,636$\frac{4}{11}$	£7.363$\frac{7}{11}$
Second Year	$\frac{9}{55}$ of £9,000	£1,472$\frac{8}{11}$	£5,890$\frac{10}{11}$
Third Year	$\frac{8}{55}$ of £9,000	£1,309$\frac{1}{11}$	£4,581$\frac{9}{11}$
Fourth Year	$\frac{7}{55}$ of £9,000	£1,145$\frac{5}{11}$	£3,436$\frac{4}{11}$
Fifth Year	$\frac{6}{55}$ of £9,000	£ 981$\frac{9}{11}$	£2,454$\frac{6}{11}$
Sixth Year	$\frac{5}{55}$ of £9,000	£ 818$\frac{2}{11}$	£1,636$\frac{4}{11}$
Seventh Year	$\frac{4}{55}$ of £9,000	£ 654$\frac{6}{11}$	£ 981$\frac{9}{11}$
Eighth Year	$\frac{3}{55}$ of £9,000	£ 490$\frac{10}{11}$	£ 490$\frac{10}{11}$
Ninth Year	$\frac{2}{55}$ of £9,000	£ 327$\frac{3}{11}$	£ 163$\frac{7}{11}$
Tenth Year	$\frac{1}{55}$ of £9,000	£ 163$\frac{7}{11}$	
		£9,000	

3. *Compound Interest Methods.*

(a) *Sinking Fund.*

Under this method an amount is set aside which, if placed at compound interest, would accumulate to an amount to correspond with the total depreciation to be provided in connection with the asset. An example of this method is shown in Figure No. 103.

FIGURE NO. 103.

COMPOUND INTEREST METHOD OF DEPRECIATION.

Year	*Deposit*	*Interest*	*Depreciation*	*Accumulated Allowance*	*Net Book Value*
First Year ...	£228 6 3	———	£228 6 3	£ 228 6 3	£2,271 13 9
Second Year ...	228 6 3	4 11 4	232 17 7	£ 461 3 10	£2,038 16 2
Third Year ...	228 6 3	9 4 6	237 10 9	698 14 7	1,801 5 5
Fourth Year ...	228 6 3	13 19 6	242 5 9	941 0 4	1,158 19 8
Fifth Year ...	228 6 3	18 16 6	247 2 9	1,188 3 1	1,311 16 11
Sixth Year ...	228 6 3	23 15 5	252 1 8	1,440 4 9	1,059 15 3
Seventh Year	228 6 3	28 16 2	257 2 5	1,697 7 2	802 12 10
Eighth Year ...	228 6 3	33 19 1	262 5 4	1,959 12 6	540 7 6
Ninth Year ...	228 6 3	39 4 0	267 10 3	2,227 2 9	272 17 3
Tenth Year ...	228 6 3	44 11 0	272 17 3	2,500 0 0	Nil
	£2,283 2 6	216 17 6	£2,500 0 0		

(b) *Annuity.*

This is similar to the sinking fund, but in addition calculates interest in the periodic value of the asset. The amount allowed each year, therefore, covers not only depreciation, but also the interest which has been added to the value of the asset during the period. Thus, if a ten years leasehold was worth £6,800, and the investment was expected to show an earning rate of 8%, it may be calculated that this sum could be recouped by an annuity of £500 per year. This sum of £500 would therefore be the amount set aside each year.

Treatment in Accounting Records.

Before giving consideration to the exact treatment in the books of account, some attention must be paid to the method of arriving at the value of the asset. In the case of a machine, for example, this may not, and probably would not, mean the first cost of the machine. In addition to the invoice value, other charges would accrue, such as landing charges, and/or freight, cartages, etc., cost of foundations, auxiliary equipment, tools, jigs and fixtures. This is shown in Figure 104 which is taken from "Transactions," U.S.A., A.S.M.E., Vol. LIV., No. 14, p. 5. It is necessary, therefore to decide just what amount should be included in the initial cost of the asset.

FIGURE NO. 104

ELEMENTS OF PRIME INVESTMENT.

<table>
<tr><td>Catalog Investment</td><td>Purchase Price or Price of Construction</td><td rowspan="5">GROSS INITIAL INVESTMENT (Charged to Assets)</td><td rowspan="6">TOTAL MONETARY REQUIREMENT</td><td rowspan="2">Re-Sale Value</td><td>Net Re-sale Value</td><td>Net Salvage Value</td></tr>
<tr><td rowspan="2">Uncataloged Investment</td><td>Cost of Transportation</td><td>Cost of Removal</td><td rowspan="5">Portion of money which has to be earned back from operation or savings through replacement</td></tr>
<tr><td>Installation Foundation (Wiring, Piping ....)</td><td colspan="2" rowspan="3">Net Investment</td></tr>
<tr><td colspan="2">Supplementary, Auxiliary Equipment
(Shafts, Motors ....)</td></tr>
<tr><td colspan="2">Cost of Accessories (Stand, Tools, Jigs, Fixtures)</td></tr>
<tr><td colspan="2">Incidental Costs, Such as Testing After Installation,
First Instruction</td><td>Charged to Current Expense</td><td colspan="2"></td></tr>
</table>

Property and Plant Ledgers.

In relation to the actual accounting records these usually take two forms. In the general ledger there is usually an account for each type of fixed asset, e.g., Land, Buildings, Plant and Equipment, etc. These assets should be supported by a Property or Plant Ledger. A Property Ledger may include full particulars of Land and Buildings as well as Plant. The Plant Ledger obviously usually covers Plant and Equipment only.

Figures Nos. 105 and 106 show examples of Plant Ledger Forms.

FIGURE No. 105.
PLANT REGISTER.

Machine No. ....
Make ....
Purpose ....
Purchased from ....
Depreciation Plan ....
Motive Power ....
Floor Space .... Sq. Ft. .... Located in Dept. ....

	Value		
First Cost			
Duty			
Other Charges			
Sales Tax			
Installation Cost			

Year	%	Depreciation	Capital Value	Maintenance	Year	%	Depreciation	Capital Value	Maintenance	History		
										Date	M. No	Record of Change

Month	Year 19	Year 19	Year 19	Year 19	Year 19	Year 19	Year 19	Year 19	Year 19	Year 19
July										
August										
September										
October										
November										
December										
January										
February										
March										
April										
May										
June										

FIGURE NO. 106.

PLANT LEDGER.

Description of Plant..................................Name ....

Technical Details :

Date of Purchase...............Insurance Value...............Serial No................

Vendor..............................Floor Space Occupied.........Location................

Date of Installation............Power Required...............Department ....

Initial Cost Price £	Landed Cost .. £	Est. Scrap Value £
Other Charges—	Foundations ... £	Estimated Life
Freight £	Power ... . £	Monthly Depreciation Charge £
Handling £ £	Installation Costs £	
Landed Cost £	Installed Cost £	Annual Depreciation Charge £

Year	Value of Asset	Value of Additions or Deductions	Total Depreciation Value	Depreciation Allowed	Net Asset Value	Remarks
1931						
1932						
1933						
1934						
1935						
1936						
1937						
1938						
1939						
1940						

Disposal   Authorised by...............

Scrapped... . .. .

Sold . ...

Exchanged for ....

Accounting Entries.

The method of charging depreciation into the cost of products has been dealt with in earlier chapters, and it is only necessary to add that the total amount of the depreciation allowed for the period is usually brought into the books by an entry similar to the following:—

Depreciation A/c Dr. £" x "
To Reserve for Depreciation A/c Cr. £" x "
(Being Depreciation charged for the period.)

Depletion Accounts.

A typical treatment of depletion in the General Ledger would be as under:—

TIMBER A/c.

To Cost of Standing Timber £4,000	

TIMBER DEPLETION A/c.

	By Timber Cut for Period— 1,050,000 s. ft. 2/- per 100 s. ft. £1,050

Importance of Depreciation Outlook.

The question of depreciation is an extremely important one and management is under a solemn obligation to see that its policy in this regard is soundly based. The financial stability of a business can be wrecked by a poor depreciation policy. If the amount of depreciation allowed is insufficient it means that the correct proportion of assets being consumed is not being charged to customers and is therefore not being recouped to the business. Unless care is shown at the outset, a realisation of just what is happening may come only when the damage is already done. It is also necessary to note that Income Tax Rates are based upon generalities and whilst there may be a legal escape for management in accepting the rates, there may be moral blame where careful investigation could have shown that the amounts allowed by the Taxation Department were insufficient and the business should, of itself, have provided higher rates. In the past organisations have been ruined by weak depreciation policy, but fortunately management of to-day seems to be better acquainted with the importance of this item.

There are three popular misconceptions in relation to Depreciation:—

1. That it represents a fund of money.
2. That it represents a reservation of profits.
3. That it constitutes inherently a provision for replacement.

As far as the cost accountant is concerned, there is a distinct obligation upon him to report any cases which come to his knowledge where depreciation is insufficient. He is not presumed to be an engineer, but because of the nature of his work he is often in a position to help management with advice in relation to depreciation factors, and, above all, he must see that the depreciation duly allowed finds its way correctly into the costs he furnishes.

Summary of Depreciation Methods in Practice.

A research enquiry was recently conducted into current practice in U.S.A. in relation to Accounting for Depreciation by Professor Wyman P. Fiske of the Massachusetts Institute of Technology and William Gardner Barker II of the Lever Brothers Company, Cambridge, and was reported in "The Controller" of January, 1938, as follows:—

Conduct of Investigation.

"The objective of the study was to determine (1) bases for depreciation in actual use and their relative importance in terms of numbers; (2) whether there was any apparent trend in methods followed; and (3) the supporting reasons for change or continuation of existing methods. It was hoped that by analysing and synthesising the views of many executives, each in a position to make policy decisions, a clearer picture would be developed than it would be possible for any one man to draw from his own experience.

Practical considerations forced limitation of the investigation to manufacturing concerns and exclusion therefrom of merchandising, service, public utility, transportation and financial organisations. Letters were addressed to 510 manufacturing companies, the names having been selected from the membership roster of The Controllers Institute of America, from corporations listed on the New York Stock Exchange, and from companies included in Moody's Industrial Manual. Each Company was asked to provide information in regard to the following points:—

1. Basis for determining depreciation currently in use and the date of its adoption.
2. Reasons impelling decision to adopt method in actual use.
3. Present attitude towards basis in use, with comments on influence of the depression, undistributed profits tax, T.D. 4422, and the like.
4. Other bases used since 1925.
5. Contemplated changes in basis and reasons therefor.
6. Basis employed for tax purposes and reasons for any difference from that used for financial and cost accounting.
7. Predominant reason for retirement of equipment. Wear and tear or obsolescence ?
8. Opinion as to desirability of relating depreciation charges to volume of production; to profits.

The returns from the mailing were more than satisfactory. Answers were received from 223 of the 510 concerns to which letters were sent—a return of almost 45 per cent.

Analysis of Returns.

Of the 223 replies received, 215 were in such form that they could be used. The 215 cases were first analysed in terms of bases followed and industries represented. The basis classifications followed the abbreviated definitions indicated below:—

1. " Straight-Line Time." In this classification were included all companies apportioning the net cost of the assets in terms of time, with equal charges in every equal time period, regardless of conditions.

2. " Diminishing Balance." The companies in this group took as their annual depreciation charge a constant percentage of the net depreciated value of fixed assets. The method assumed some salvage value, as it could never completely amortise the cost of any asset. It also resulted in higher depreciation in the earlier years of use.

3. " Straight-Line Time with Arbitrary Rate Changes." This classification was basically straight-line time, but with some arbitrary variation, such as :

(a) reduction of rate in depression years ;

(b) arbitrarily higher rates for the first three or four years.

4. " Unit of Production." Under this method a unit depreciation charge was set up for each unit of production—as ton of iron, barrel of oil, case of canned goods, machine hour, and the like. The annual depreciation charge was computed by multiplying the unit charge by the number of units produced during the year.

5. " Per Cent of Normal Factor." The straight-line basis was followed to determine a charge for a year of " normal production," which was set in terms of production units of capacity. In any year the actual depreciation charge was that percentage of the " normal " charge which actual production bears to " normal " production.

6. " Flat Charge." The officers set up an entirely arbitrary charge, frequently based on what earnings could stand.

7. "Remaining Useful Life Based on Periodic Appraisals." Companies in this classification made periodic appraisals of their assets and redetermined depreciation charges on the basis of such appraisals. This was the method suggested in T.D. 4422.

8. "Constant Wear and Tear with Fluctuating Obsolescence." Wear and tear was covered on a straight-line basis. Reservations were made for obsolescence on a fluctuating, arbitrary basis.

9. "Obsolescence Constant, Wear and Tear a per Cent of Normal." Depreciation was first computed on a straight-line basis. The annual charge was then divided to cover obsolescence and wear and tear. The obsolescence portion was taken regardless of conditions. The wear and tear part was allowed to fluctuate as under (5) "Per Cent of Normal Factor."

Methods in Use.

The returns showed, as was expected, a great preponderance of companies using the straight-line time method of determining depreciation. Of the 215 companies, 178, or 83%, used this method. This basis was followed by a majority of companies in all types of industry, and was the only method reported in nine industries: food products, printing, light chemicals and drugs, sugar, shoes and clothing, tobacco and glass.

The next most popular basis was the unit of production approach, used by nine companies or 4%. Most of these cases appeared in the extractive industry group. The order of importance of the remaining bases was (3) Per Cent of Normal Factors, (4) Remaining Life by Periodic Appraisals, (5) Diminishing Balance, (6) Straight Line with Arbitrary Rate Changes and (7) Flat Charge. When all those methods which gave some effect to changes in production activity were grouped together the total was 21 or about 10%.

Reasons for Use of Various Methods.

The most common reason given for using the straight-line method was that most other companies seemed to be using it and it was the generally accepted method. The following remarks are typical of the reasons frequently given for its adoption:—

"It was chosen because of its simplicity and the fact that the amount can be determined accurately in advance." "We chose this method as we felt that, regardless of the method used, it had to be an estimate. Consequently, we used the one which, in our opinion, had the least number of complications." "(a) It is in very common practice. (b) It is acceptable to the Internal Revenue Department . . . . . It is the generally accepted method."

Attempt to Approximate Facts.

The main case put forward for other methods was that the straight-line time method was too inflexible and did not come close enough to the actual facts of the case. Therefore in an attempt more closely to approximate the facts, various companies adopted the several other methods that appeared in this survey. A few companies saw in the production bases a means to iron out the wide variations in profits between years and keep some funds in the business without being liable for the large undistributed profits tax. The production method would lead to a high depreciation charge in profitable years, and a small one in lean years, with the virtual effect of transferring some of the profits from year to year.

Many companies felt that the actual wear and tear on the machinery did depend on production and hence depreciation should be related to production. This feeling was evident in the writings of many companies that were using the straight-line method, as well as of those which had embraced the production method. There were those, however, that countered that this was a specious argument since machinery would rust out and deteriorate during a shut down as fast as it would if being run regularly, and that the obsolescence factor was higher during a depression because the machine tool manufacturers were using all their ingenuity to improve money-saving machinery in order to make a sale.

Trend in Depreciation Bases.

No actual trend away from the straight-line basis could be discovered. Dissatisfaction with the basis was expressed in a considerable number of cases. The widespread belief that production activity should be recognised has been commented upon. Whether this forecasts a trend towards bases having this characteristic cannot be stated. It is an interesting possibility. Certainly continuance of the undistributed profits tax accompanied by wide fluctuations in volume of production will prompt a re-examination of depreciation bases.

Summary of Conclusions.

Conclusions suggested by the study may be summarised as follows:—

(1) Straight-Line basis for determining depreciation is still overwhelmingly the most popular and generally used. Between 80% and 85% of all companies co-operating in this survey indicated the use of this basis.

(2) Something under 10% of the companies used bases either directly connected with units of production or affected by the rate of production.

(3) As would be expected, the type of industry appeared to be a factor in the selection of bases other than the straight line. Thus we found extractive industries showing the greatest number of cases of a production-unit basis.

(4) There is no evidence of a present actual trend away from the use of the straight-line basis. It appears significant, however, that of those responding to the question seeking information as to whether the production rate should be recognised in the basis of depreciation, something more than 50% of the replies were favourable to recognition of this factor. The feeling that production requires recognition in the depreciation basis seems to run through the whole gamut of industry. Only three striking cases of industrial preference appear. The extractive industries favor the relation of production better than two to one. On the other hand, there are two industries that are strong dissenters, the textile and food products industries, which voted one to seven and four to nine, respectively, against any such relationship. Certainly the existence of any such widely held point of view is one interesting result of the survey. Whether there can be drawn a conclusion that the production basis will receive more favorable consideration in the future, is, of course, debatable."

In Australia, the use of the Diminishing Cost Method is much more popular than in America and this is no doubt due to its general acceptance by the Income Tax Department.

CHAPTER 30

INTEREST AS AN ELEMENT OF COST

The Difference in Opinion.

The question of whether interest should be included as part of the cost of production is probably the most controversial one which has formed the basis of discussion amongst cost accountants. Not only was opinion fairly evenly divided, but the contentions of the supporters of each basis were very warmly defended. From the period of the first world war until nearly the time of the depression, discussion raged continually. In 1921, however, the subject was most exhaustively examined by the National Association of Cost Accountants of U.S.A., in an annual session virtually devoted to it. Whilst the controversy continued for some few years after this, it gradually lost its importance until to-day, though still debated, it is of very secondary importance.

The problem arises primarily out of the economic definition of profit. In this, two elements are distinguished—the first being the rate of interest allowable in respect of capital supplied to a business, which is really regarded as a loan to that business, and, secondly, a return or reward to capital for the fact that it is risked in the business venture.

All cost accountants agree that interest on capital is either part of profit or part of cost. It must be one or the other, and cannot be both. The difference in thought arises from the contentions held—one maintains that interest is part of profit, and the other that it is part of cost. The latter section being consistent argues that, being part of cost, interest should be included as an element of cost in manufacturing. As all costs should be included, and interest is a cost, statements of manufacturing costs are not complete without the inclusion of the amount of interest on capital.

Briefly, the arguments advanced in favour of the treatment of interest as part of cost are:—

1. Accounting theory and practice should be in line with economic theory and definition.
2. The inclusion of interest makes for true cost, and facilitates the preparation of comparative statistics.
3. Inclusion is necessary in order to fix selling prices.
4. Some materials acquire an enhanced value after they have matured or been seasoned. Business must be charged for the use of capital, otherwise the capital could be earning interest elsewhere.
5. Capital borrowed has to be paid a sum in interest. This should be regarded as part of cost, and therefore shareholders providing capital should receive interest.
6. The inclusion of interest is necessary to account in correct fashion for the time element in cost.
7. As interest is a cost, profits are not inflated by the inclusion of interest, any more than with any other cost.

The arguments against the inclusion of interest in cost are:—

1. There is no need whatsoever for accounting practice to follow economic theory.
2. There is great difficulty in determining the rate of interest to be used.
3. It is usually found that interest is more or less a constant element, and its effect in cost is generally over-stated.
4. The inclusion of interest can quite easily mean that profit is anticipated before being earned.
5. Interest is a matter of finance, not of manufacturing.
6. The charging of interest is an unnecessary complication, and may result in misleading information.

Finally, the advocates against inclusion state:—

7. The inclusion of interest in the accounts, is not necessary for comparative statements, because statistical figures, taking into account interest, can be made outside the accounts.

It will be seen that some of the arguments advanced by one side are in flat contradiction of those advocated by the other, and it is probably this flat contradiction which resulted in the vehemence which characterised past arguments, and the fact that there was little attempt at compromise.

Consideration of the Arguments.

When thoroughly analysed the arguments of those in favour of admitting interest as part of cost and entering it in the costing records accordingly are based on three main factors:—

1. The economic reason,
2. The practical reasons,
3. The accuracy reason.

1. The Economic Reason.

The inclusionist commences with a study of economic theory. He maintains that as the economist makes the clear distinction between interest and the reward for risk of capital, accounting theory should give effect to those factors, and the cost accounts should show the implications of such. It is pointed out that interest is as much an item of cost as productive wages. The latter are the reward of labour, and interest that of capital. Human labour has often been displaced almost entirely by machinery, and interest on the capital sunk in the machinery is a charge to cover the hire of that capital.

The opinions of the economists are clearly shown from the following quotations:—

E. R. A. Seligman ("Principles of Economics," page 354)—

"The expenses of production . . . . may ordinarily be classified into cost of raw material, wages, rent, interest on the capital borrowed or invested, taxes, and miscellaneous outlays like insurance, advertisements and transportation expenses . . . ."

Page 357: "The older writers confused interest with profit. Interest is the return from the fund of capital; profits are the return from the conduct of business enterprise, irrespective of whether the enterprise deals with capital or labour, or both. Interest is a part of cost; profit is a surplus above cost. Interest has a normal rate; profits may have an average rate but no normal rate.

"Just as a business man must deduct the rent or royalty of some patented machine used by him before computing his profits, so, if he buys the machine outright, he must deduct the interest on the capital invested in the machine. Whether he uses his own capital or borrows it is immaterial; in the latter case it is loan or contract interest, in the former it is natural or economic interest."

F. W. Taussig ("Principles of Economics," Revised Edition of 1915, Chap. 50, page 179).

"We have tacitly assumed that so much only of a business man's income is to be regarded as profits as is in excess of interest on the capital which he manages. If he happens to borrow his capital, this is clearly true. He then pays interest to another, and only his net earnings over and above interest go to him as business profits. Usually his capital is partly borrowed and partly his own . . . . On that part which is his own, he must indeed remember that interest could be got at current rates without the risk and labour of actual management; and therefore he must reasonably reckon only the excess over such interest as his earnings of management or business profits."

The arguments advanced against the inclusion of interest in this connection mainly rest upon the statement that there is no necessity for accounting practice to follow economic theory. Indeed, it is urged that if it should do so, then it should also be consistent in its approach and all its records should be drafted to suit the views of economists, rather than the needs of business. If economic theory is the guide, then a change in accounting theory would presumably follow any change or refinement in economic theory. Furthermore, there are other economic theories to which effect is not given in accounting treatment. To be consistent, more than one change would have to be made.

In addition to this factor, a difficulty arises in relation to the rate of interest to be charged. Here, the economist naturally adopts a purely theoretical view, but in seeking to interpret the charge obviously only practical realities are of any use. The rate which should be adopted may bear little relationship to the pure hypothetical rate of the economist.

Above all, however, there is the fact that some economists themselves argue that there is no need to include interest as a cost of production. A case in point is to be found in a speech by Dr. Francis Walker, Chief Economist of the Federal Trade Commission, U.S.A., reported in the 1921 Year Book of the National Association of Cost Accountants of U.S.A.

"The economists in general say that in the long run prices equal the cost of production but they include in the cost of production rent, wages, interest and profit. They are talking about the *social* cost and the distribution or division of the wealth created by the use of labour, land, capital and managerial enterprise among labour. the owners of land and capital, and the undertaker of business enterprise. The cost accountant, however, is generally dealing with the cost of production of a particular company, and he finds a different set of conditions, must make a different analysis, and requires a different terminology. He cannot consistently put interest into cost without likewise putting profits into cost, and if he should do that he, too, would get something that more or less approaches price . . . . The most decisive argument against including hypothetical interest in cost of production, perhaps, was the fact that if it were put into the cost and deducted from the receipts, it would have to be added back to determine profits. In other words, it appears that this interest which was called a cost is also a profit. This appearing to be a contradiction in terms, it was logically necessary to conclude that it was a part of profit and not of cost."

The non-inclusionists do not admit the validity of the argument that if the amount of capital were invested elsewhere interest could be obtained, because they feel that this has no bearing on the subject. The facts are that the shareholders have not invested this capital elsewhere, and they have invested it in the business under consideration. In any case any claim for preferential treatment in relation to interest on capital credited to shareholders has never received and could not receive the support of the Courts.

The arguments centred round economic theory, both for and against the inclusion of interest in cost could be amplified, but it is felt that sufficient has been outlined to indicate the main bases of the rival contentions raised.

Turning away from the economists, the following extract from "My Life and Work," by Ford (Fol. 39-40), is of interest:—

> " I have never been able to understand on what theory an original investment of monev can be charged against a business. Those men in business who call themselves financiers, say that money is " worth " 6% or 5% or some other %. and thus if a business has 100,000 dollars invested in it the man who made the investment is entitled to charge an Interest payment on the money because, if instead of paying that money into a business, he had put it into a Savings Bank or into certain securities, he could have a certain fixed return.
>
> Therefore they say that a proper charge against the operating expenses of the business is the interest on this money. This idea is at the root of many business failures and most service failures. Money is not worth a particular amount. As money it is not worth anything, for it will do nothing of itself. The only use of money is to buy tools to work with or the product of tools. Therefore, money is worth what it will help you to produce, or to place it where it can get that return *but money placed in a business is not a charge on the business, or, rather, should not be,* it ceases to be money and becomes, or should become, an engine of production and it is, therefore, worth what it produces and not a fixed sum according to some scale that has no bearing upon the particular business in which the money has been placed.
>
> Any return should come after it is produced, not before."

2. The Practical Reasons.

A strong argument is made by the inclusionists that interest should be treated as part of cost, because its inclusion is essential to the writing of a true picture in relation to certain factors concerning which the business executive must make judgments from time to time. Some of these are briefly outlined hereunder:—

(a) *Comparative costs between methods.* These may take various forms, as, for example:—

1. The comparison between machines and hand labour. Sometimes work is carried out by both methods, and it may be necessary to shut down either one or the other, or to expand one or the other Only by the inclusion of interest can an accurate picture be obtained.
2. Similarly, the operations of different types of machines may arise for consideration, the capital cost of one being very much greater than that of the other. A true picture is obtained only if the interest factor in each is taken into account.
3. The purchase of certain products or components may be an alternative against manufacture. The amount of capital that it would be necessary to spend upon the purchase of the necessary productive plant and equipment must be taken into account, and the interest factor involved must be weighed up when determining costs of the two alternatives.
4. Rental and purchase of a building may come up for consideration. The rent may be accepted as a cost. It is contended that if capital is spent on buying the building, interest should also be treated as a cost.
5. Different methods of financing may have repercussions in the productive sphere, and these may be judged only when the amount of interest involved can be taken into account.

(b) *Comparative costs between periods.* A true conception of the real position and a clear picture in relation to trends may be obtained only by setting forth results of various periods after the inclusion of interest. In one period, for example, a larger amount of capital may be used, and the inclusion of interest may act as a levelling agent. Furthermore the inclusion of interest in productive costs for various periods, may bring home to management the effect of excess fixed or current assets.

(c) *Comparisons between departments.* Just as it is necessary to apportion rent upon a square footage basis as between one department and another, so, it is contended, it is necessary to charge interest to obtain a true perspective.

(d) *Comparison between products.* Just as in the case of salesmen where the final analysis of respective worth to a business of each member of the sales staff must be interpreted in terms of net profit, and not sales, so, the inclusionist maintains, any comparison between products as to their value to the business, must also be surveyed in terms of net profit, and this can only be accomplished where due regard is paid to the effect upon costs of the inclusion of interest. If, for example, product "A" returns a net profit to the business of £500, and product "B" £400, the claims of product "A" to be considered as better than product "B" may be undoubted. It may be found on further analysis, however, that it has been necessary to incur interest amounting to £300 in the case of Product "A" and £50 in the case of product "B". Whilst it may be a payable proposition to the business to have both products running, nevertheless the inclusion of the interest charge is necessary to see in accurate terms the respective real value of the two products.

The exclusionists are separated into two camps in their rebuttal of these contentions. The first group is not prepared to admit the validity of the contentions raised. It maintains that when completely analysed the inclusion of interest in comparative statements is much over-rated in point of value. The second group argues that there may be something to gain in the production of comparative statements including interest, but that all necessary benefits can be conferred by preparing these statements outside the financial books. These can be carried out as statistical tables, and there is therefore no need to include interest in the books of account. They do not admit the validity of the contention that only where costs are included in the financial records is there a sufficient tie-up to ensure accuracy.

The opinions of the first group are best summed up in two statements taken from the 1921 Year Book of the National Association of Cost Accountants, U.S.A. The first is by Mr. E. Elmer Staub, of the Hudson Motor Car Company.

> " In getting a true conception of the value of one inventory policy over another, interest is of little or no value, as there are many other factors which enter into consideration such as possible market fluctuations, production schedule, availability of material, conditions of transportation and a lot of items which are practical, not theoretical . . . . Not once in the last five years (when we have handled many million dollars worth of inventories and considered many policies and different situations) would the matter of interest, even if it had appeared, have altered the decision one bit, because the other items were of vital and more practical importance."

Similarly, a representative of the English Institute of Costs and Works' Accountants, Mr. R. Dunkerley of Manchester, England, said:—

> " We are also interested in the use made of costs. This seems to be a matter which influences the minds of many accountants. If it is a case of comparing manufacturing costs then we think it is a highly dangerous policy to include interest in costs."

The second group maintains that all the advantages to be gained by comparisons including interest can be obtained without inviting the complications attendant upon its inclusion in the financial accounts. It is pointed out that this not only inflates stocks, but unless some adjustment is made, it anticipates profits. If the adjustment is made, then it is tantamount to an admission that interest is a cost, providing the goods are sold by the end of the balancing period, but if they are not, it is not a cost and the entry should be reversed.

The second reason of a practical nature advanced by the inclusionists is that interest should be included as part of cost so that selling prices can be determined more accurately. It is pointed out that the selling price should cover manufacturing costs, distribution and administrative costs, and in the first named the amount of interest applicable to the product should be included. To the total of these costs should be added the reward of the entrepreneur, the total of all these factors giving the selling price. In actual fact, however, the principal of what the traffic will bear is as important a factor as any. Furthermore, it is contended that the same result can be achieved by allowing a higher margin to the entrepreneur to cover both his reward and his interest on capital.

The third matter which is raised in support of interest being treated as part of cost. is that in the case of uniform accounting, not only a more realistic, but also a more standardised approach is possible by all members. It provides for uniformity of condition and true comparisons are facilitated. It is true that many uniform accounting systems have specified the inclusion of interest as a cost, and this seems to be a generally acceptable standpoint. There are some, however, who advocate its exclusion, though these are definitely in the minority.

3. The Accuracy (or Factual) Reason.

There are some manufacturing enterprises which deal with products which definitely increase in value with effluxion of time. One of the most common of these is the timber industry, where boards after leaving the saw may be stacked and allowed to air-season. There is an alternative, as the seasoning may be carried out in drying kilns. In the latter case usually some air-seasoning is necessary, and when the moisture content has dropped to a certain acceptable figure (usually depending upon the species of the timber, its condition, dimensions and proposed use) it can be transferred to the drying kilns, which will carry out the remainder of the drying process in a much shortened time. Seasoned timber is more valuable than green timber, and two factors emerge. In the first place, with air-dried timber, no money is spent upon the product from the time it is filleted out until such time as it is ready for use as furniture boards, with the possible exception of amounts like fire insurance. The air-seasoning process may take two or three years, and it can therefore be understood that the capital represented by the timber is locked up for that period. It is contended that the accretion in value should be offset by the interest cost, attaching to the idle capital for this specific period.

A strong argument can also be advanced that in any comparison between air-drying and kiln-drying costs, interest on capital employed should be taken into account.

It is difficult to oppose the contentions raised in this matter. It is a special case (and there are others many of which are associated with maturing processes) which possibly should be regarded on its merits. The position is, however, somewhat different in this case, because the effluxion of time has definitely had an effect upon the value of the timber and provides an automatic increase in the selling value of the product. This is in contra-distinction to most other cases, for interest on capital does not usually increase values.

Available Alternatives.

The following are the main alternative treatments possible:—

1. Interest can be excluded as advocated by the exclusionists.
2. It can be included in the financial accounts, and no adjustment need be made at the end of the period.
3. It can be included in the financial accounts, but an adjustment may be made at the end of the period.
4. A certain portion of interest can be included in the financial books.
5. It can be excluded from the financial books, but statistical returns including interest as part of cost can be prepared.

Accounting Treatment.

The accounting treatment necessary to give effect to the above is considered hereunder:—

1. Interest can be left out of the accounts.

This requires no explanation and no entries. It is still the most favoured practice.

2, 3 and 4. Interest can be included in the cost accounting records as part of the cost of production and no adjustment need be made at the end of the period, or alternatively a partial adjustment can be made.

It will be necessary to prepare the journal entries to give effect to these arrangements. These would be as follows:—

Assuming that a building cost £60,000, the interest at 5% would be £3,000. An examination of the square footage of the building discloses that it is used by:—

Department 1.	10%
,, 2.	15%
,, 3.	20%
,, 4.	30%
Power and Boilerhouse	25%.

(For the sake of simplicity Services have been eliminated).

Building Expense	£3,000	
To Interest Charged to Cost		£3,000

(Being allowance of interest on capital cost of factory building)

The distribution would then be made:—

Department No. 1	300	
„ „ 2	450	
„ „ 3	600	
„ „ 4	900	
Power Costs	750	
To Building Expense		3,000

(Being apportionment of building expense for the period)

Actually interest would be one of several items combining to make up the total of interest expense. The allowance for interest would be included in all expense budgets, and would play its part in arriving at the expense rate. A Standing Order would be open to which would be journalised the amount of interest for the period, just as in the case of any other factory expense. Once an allowance for interest has found its way into the various departmental expense accounts, it would automatically be transferred to the costs of products or processes, both in relation to work in process and finished stock. Some of the latter would presumably be sold, and the amount finally found in cost of sales.

To clear the interest charged to cost account a journal entry would be passed:—

Interest charged to cost ...Dr.	£3,000	
To Profit and Loss A/c. ... Cr.		£3,000

(Being amount of interest charged into cost of production)

Inclusionists who advocate no adjustment would then automatically leave the entry in Profit & Loss A/c., and it would be found in the net profit for the period.

If, however, it is desired to make an adjustment, this can be adjusted in the following ways, all of which necessitate computations of the amount of interest charged into the cost of goods sold, finished stock and work in process.

It is assumed in the following example, that of the amount of £3,000, £2,000 has been included in the cost of sales, £750 in Finished Stock and £250 in work in process. Actually, these computations should be made by ascertaining the expense rate as applicable to interest only, and calculating from this the amount of interest included in the various stages of production. This can be a very complicated process, and, at times, a judged apportionment is made without the detailed calculation.

In the instance given above, it may be decided to leave the amount of interest applicable to cost of sales in that account, but transfer the amount relating to finished stock and work in process to a reserve account. It may be recognised that it is very undesirable to anticipate profit by an interest charge, hence the desired transfer. The entry would be either

Interest Charged to Cost	£1,000	
To Interest Reserve A/c....		£1,000

(Being transfer of interest charged in finished stock and work in Process)

or

Profit & Loss A/c.	1,000	
To Interest Reserve A/c....		1,000

(Being interest charged in finished stock and work in process.)

It may be desired to adjust the finished stock and work in process accounts in which case it would be entered:—

Interest Charged to Cost	1,000	
To Finished Stock		750
Work in Process		250

(Being interest charged in finished stock and work in process.)

Alternatively, the whole of the stocks accounts could be adjusted by including cost of sales in the entry, thus:—

Interest Charged to Cost	3,000	
To Cost of Sales		2,000
Finished Stock		750
Work in Process		250

(Being adjustment of interest charged in to cost of production.)

Interest charges on current assets would be covered in similar fashion. The usual case would be in respect of raw materials, in which an interest charge of, say, 5% may be included in the value of all materials issued into production. The total of all such charges would be covered by a journal entry:—

Raw Materials Interest Charge .. .. Dr.
To Interest Charged to Cost ... ... Cr.

The operation of this account would be similar to any other material handling charge added to the invoice price of raw materials, except that instead of creating the liability for wages, an expense a/c or to an outside creditor, it would be credited to Interest Charged to Cost. Thus, if the invoice cost of raw material "a" was 5/-, the handling charges 1/- and interest charge 3d., the raw materials would be priced on requisitions at 6/3. The total amount of interest represented by the 3d. charge would find its way to the credit of Interest Charged to Cost.

5. The inclusion of interest in comparative statements.

(a) *Comparison between machines and hand labour.*

It may be desirable to ascertain the respective costs of production of work carried out by machines and with hand labour, and it may be necessary to include interest on the capital cost of the machine, for the purpose of obtaining a true picture of the position. The figures may be as under:—

MACHINE COST

Depreciation	£54
Insurance	2
Repairs & Maintenance	34
Indirect Materials	10
Rent of Floor Space	20
Superintendence	180
Power	90
Interest	30
Wages—1 man and a boy	580
	£1,000
Number of Units produced	10,000 units
Cost per Unit	2/-

COST BY HAND LABOUR.

Wages—2 men and 1 boy	£850
Sundries	30
Increased Material Cost—5% of £2,000	100
	£980
Number of Units produced	10,000 units
Cost per Unit	1/11.52

In the above example, the cost by hand labour works out at slightly less than the cost by machine. If, however, interest had not been included to arrive at a machine cost, the cost per unit by machine would have been 1/11.28, in which case it could be said that the machine rate was the cheaper. In this example, the figures have been prepared in such a way, as to show that interest was the factor responsible for the machine being either over or under the hand rate. This may, however, seldom be the case and this is one of the strong arguments raised by the exclusionists. In the above case, for example, there would probably be a number of other factors which would be taken into account in arriving at a decision.

(b) *Comparison between two machines.*

It may be found that 20,000 units of product will be needed, and these can be obtained by two machines, the costs in connection with each being the same as shown in the previous example. This would mean a total cost of £2,000, and a unit cost of 2/- per unit. (In actual practice it may be found that costs of two machines would not be double the costs of one machine). Another machine with a capacity of 50,000 units in the same period can be obtained, and costs of production calculated in relation to this machine are shown hereunder:—

Depreciation	£400
Insurance	5
Repairs & Maintenance	50
Indirect Materials	25
Rent	25
Superintendence	180
Power	350
Interest	300
Wages—2 men & 1 boy	750
	£2,085
Number of units produced	20,000 units
Cost per Unit	2/1.02

If interest was excluded, the cost would be 1/9.42 per unit. Here again, therefore, if interest is included, the two machines are the better proposition. If interest is excluded the large machine is the better. Again, however, other factors would probably be of more importance in making a decision, where costs are reasonably in line. The fact that there was reserve capacity of 30,000 units may be a most vital matter and possibilities of increasing trade and the operation of differential costs, may be all-important.

(c) *Comparison between Purchase and Manufacture.*

The Cost to Manufacture in the previous example, with the large machine, was, say 2/1. It may be possible to purchase this product at 1/11½. Whilst the production cost would be 2/1. including interest, it was 1/9.42

without such charge. With interest, purchasing is the more profitable method, whilst with the exclusion of interest it would pay to manufacture. This is a further illustration of where it is quite likely the matter would be determined by other factors.

(d) *Comparisons between Net Profits of Products.*

The net profit figures relating to two products are as under:—

	Product "A"	Product "B"
All other manufacturing costs...	5/6	13/4
Proportion interest chargeable...	6	2/2
Total	6/-	15/6
Selling Price	8/-	£1 0 0
Profit	2/-	4/6

Without the inclusion of interest, the net profits would be :—

Product "A" — 2/6 on 8/-...	31% approx.
„ "B" — 6/8 on 20/-	33⅓%

After the inclusion of interest, the respective figures would be as under :—

Product "A" — 2/- on 8/-	25%
„ "B"—4/6 on 20/- ...	22½%

Thus, without taking into account interest charges, Product "B" gives a better rate of profit than Product "A". When interest is included Product "A" is the better.

Accretion of Value Through Time.

There are undoubtedly products which gain in value through the effluxion of time, and the element of interest may be a very important one. This is particularly so in the case of timber, as the time element can be shortened by a modern method of treatment. Timber Boards for use in furniture can, after being sawn from the log, be filleted and racked and left to air-dry until the moisture content has been reduced to an acceptable figure. This may take, say, two years. The boards may then be fit for sale as seasoned timber. An alternative method, however, is to leave the boards after racking to be air-dried for, say, six months, and then send them to drying kilns to be kiln-dried. This latter hastens the drying process, usually gives a more acceptable board with a lower moisture content. It may be desirable to take out comparative cost statements to show which of the two methods is the more desirable.

The figures involved may be:—

Cost of Air-Drying—

To Cost of Timber—	
400,000 super feet @ 20/- racked per 100 s. ft.	£4,000
Rent of Yard for two years	150
Insurance	200
Handling Costs	250
Interest Charge 5% on £4,000 for two years	400
	£5,000
Selling Price of Boards— 400,000 super feet @ 40/- per 100 s. ft.	8,000
Profit	£3,000

Cost of Kiln-Dried Timber—(including Air-Drying Six Months)—

To Cost of Timber—		
400,000 super feet @ 20/- per 100 s. ft. racked		£4,000
Rent of Yard		40
Insurance		60
Handling Costs		500
Cartage to Kilns		100
Kiln-Drying Charges		1,400
Interest Charges—		
5% on £4,000, for say 8 months, to allow for Kiln-Drying Time		133
		£6,233
Selling Price of Boards—		
400,000 super feet @ 47/- per 100 s. ft.		9,400
	Profit	£3,167

An examination of the above figures shows that with the inclusion of interest the profits are:—

Air-Drying	£3,000
Kiln-Drying	3,167

and without interest:

Air-Drying	3,400
Kiln-Drying	3,300

No attempt has been made to take into account the respective spoilage and waste by the two methods. In actual practice, if the above figures represented the true position, other factors would be included in any judgment regarding respective merits. For example, the space factor may be sufficient alone to decide the matter where costs are reasonably in line.

Conclusion.

It is felt that sufficient has been said to indicate the respective views held in relation to interest and the methods of giving effect to each, both in the books of account and in comparative statements.

Probably one of the best summaries of the general position is to be found in "Accounting Method" — Second Edition 1930, by Dr. C. R. Rorem, pages 516/517:—

> " The question arises continuously in cost computation as to whether a charge which represents interest on invested capital should be included in the cost of specific commodities or services. An examination of the problem shows that it may properly be excluded for some purposes, but must be included for others. For purposes of measuring the net financial income of an enterprise during a given period, only actual interest paid on borrowed capital need be considered ; in such cases, the interest on net worth is included in the return to the proprietors as part of their annual profits. But when attention is turned to the establishment of a normal or satisfactory selling price, interest on total capital must be considered ; for capital must earn a normal rate of interest or it will, if such procedure be feasible, be transferred to other lines of industry.
>
> " For the purpose of determining profitable and unprofitable lines, comparison of data must recognise the total investment required to carry on the production of each line. Similarly, in the comparison of the efficiency of departments or processes, the amount of investment is an important factor. A process which requires a large investment may, of course, reduce the cost of a commodity, or it may not. In either case, the recognition of interest on investment makes it possible to compare processes correctly. In deciding whether to accept an order for additional product which can be produced without an increase in equipment, interest computations need not be included. On the other hand, if the additional amount of business will require the investment of additional capital, interest becomes a factor for consideration.

" The question of whether interest on total capital is a cost or not has been discussed heatedly by accountants ; however, much of the argument has arisen from misunderstandings as to the points of view of the disputants. In some cases the argument has been merely one of how interest expense was to be classified, whether as an expense of production, or as some other type of expense, such as " Selling " or " Administrative." The solution of the problem in this form depends, of course, on the particular classification of accounts which an enterprise has adopted ; it assumes that interest is to be accounted for in the double entry records.

" A sharper line of difference of opinion arises over the question of whether interest on invested capital (if a cost of operation) should find explicit recognition in the books of account. Practical accountants assert that such treatment gives rise to accounting difficulties, which confuse the records and serve no useful purpose : for debits to an Interest Expense Account require offsetting credits to an Interest Income Account representing the earnings on owned assets. The interest comes out of one pocket and goes into the other. Such a paradoxical situation is one which many practical men refuse to recognise in accounts which purport to contain data of bona fide financial transactions. Among enlightened accountants the question of whether interest is a cost seems to have been reduced to a question of whether it should be entered in the general financial accounts as affecting net income. Interest on investment is obviously an important element in cost determination, though its recognition is not necessary to the computation of net financial income. If it does not appear in the double-entry records, it must be added for certain purposes ; if it does appear in the accounts, it must be subtracted for certain purposes."

CHAPTER 31.

CONSIDERATION OF CAPACITY FACTORS.

In the foregoing Chapters consideration has been given to the preparation of expense rates on an actual or predetermined basis. The method of treatment under Standard Costs has also been considered. It now seems desirable to devote further consideration to the question of capacity and its effect upon costs and prices. It is a debatable subject and has been a matter for discussion and examination amongst cost accountants generally for a considerable number of years. Even now there is no universally accepted definition of what is meant by "normal capacity," and indeed interpretation of this phrase is largely a matter of individual taste. It seems a pity that there could not be some degree of standardisation, but admittedly the subject is difficult. Probably the main factor creating such difficulty is that differing circumstances so frequently demand a different perspective, and the result finally decided upon is given the name of "normal capacity."

It is probably true to say, however, that every cost accountant should have a thorough knowledge, not only of the different interpretations placed upon normal capacity, but also of the effect upon costs of the different bases.

Consideration of Types of Capacity.

It is necessary at the outset to analyse the word "capacity" in itself, and this can probably best be done by taking a machine and examining the various factors relating to the capacity thereof. It is assumed that this machine is used for the making of Cake Cones. It is fed with a Cake Mixture automatically poured into a mould, and the revolving of the machine enables the gas fire to bake the cone and drop it into a chute. The machine has 50 moulds and it takes 5 minutes to do a complete circle. This means that every 5 minutes 50 cones are baked. At this rate, there would be 600 cones per hour, and in a 24 hour day, 14,400 cones, or 36 boxes of 400 each. For a seven day week, there would be 252 boxes, and in a 52 week year, the total would reach 13,104 boxes. This could be referred to as *"Absolute Capacity."*

Obviously, no machine could keep on producing at such a rate, as there would be all kinds of factors to interfere. In the first place, the machine may work for only one shift of 8 hours, and may operate for only 5 days in the week. Furthermore, there may be 2 weeks holiday per year, when the machine must be overhauled, and, because of minor stoppages of all kinds, a further week may be necessary. Actually, therefore, the expected number of boxes may quite well be:—

12 boxes per day, that is 1½ boxes each hour for 8 hours, and with a five day week, and a 49 week year, the annual total would be:—

12 × 5 × 49 — 2,940 boxes.

It will be seen that there is a reduction from 13,104 to 2,940 boxes.

Even this latter figure, however, may be optimistic, inasmuch as it may be found that the machine cannot run for 8 hours unless some overtime is worked. It may require 20 minutes for heating at the beginning of the day, and the gas must be turned out at least 10 minutes before closing time so that the machine can be cleaned and ready for work next morning. This would mean that there would only be a 7½ hour day instead of 8 hours. The output would therefore be:—

1½ × 7½ × 5 × 49 — 2,756¼ boxes.

This figure, however, must be further examined, because it assumes that every cake cone turned out is acceptable for sale. This is not the position, and careful tests have shown that one cone in every 25 must be discarded. This would have the effect of reducing the 2,756¼ boxes to 2,646 boxes. (2,756¼ less 1/25th). This figure may then be referred to as the *"Practical Capacity."*

It will be seen that in order to reach practical capacity conditions must be almost ideal. In practice, however, it will be found that all kinds of conditions seek to break down the number of boxes which could be obtained. Changes of staff, variations in the type of mixture used, difficulties with the gas fires, and similar troubles may mean that this figure is higher than could reasonably be expected, and it is therefore necessary to try to arrive at a base figure which would more closely approximate what could definitely be expected. It may be decided that the conditions outlined could be taken as warranting a deduction of 20% of 2940 boxes, to arrive at a more normal figure. This would result in 2,352 boxes per year, and may be interpreted as *"Normal Capacity."*

The calculation of such normal capacity is not always carried out in the manner indicated here. It may, for example, be interpreted as being 80% (or some other figure, such as 75%) of the Practical Capacity, which, in turn, may not make any allowance for holidays, and overhaul of machinery. In other words, the deduction to arrive at Normal Capacity may be taken as covering some of the factors already considered in relation to Practical Capacity.

It should be noted that this normal capacity need have no relationship whatsoever to what is turned out by the machine, because obviously the production by the machine must be controlled according to sales demand. If, for example, this machine turned out a baked cone which was not very popular, it may be run for only sufficient time to turn out 1,000 boxes. This figure could be the average of the last three or four years, in which case it would be, say, the *"Normal Sales Capacity."*

Because of a further falling demand, it may be anticipated that for the period under review only 800 boxes will be required. This would be called the *"Current Sales Capacity."*

Effect of Capacity Upon Costs.

It will be evident that as capacity is one of the important factors in the spread of expense some ruling is necessary as to which capacity basis should be adopted for this purpose. The differences which can occur through the varying bases are best shown in the following example:—

Assume the following figures:—

Material Cost per Unit	10/-
Labour Cost per Unit	15/-
Total Expense to be Absorbed	£1,000
Total Capacity	4,000 units.
Practical Capacity	2,000 ,,
Normal Capacity	1,500 ,,
Normal Sales Capacity	1,000 ,,
Current Sales Capacity	750 ,,

It will be seen that the Expense Unit Costs are:—

Total Capacity	5/-
Practical Capacity	10/-
Normal Capacity	13/4
Normal Sales Capacity	20/-
Current Sales Capacity	26/8

This will give total Unit Costs of 30/-, 35/-, 38/4, 45/- and 51/8 respectively.

It will be seen from the foregoing that depending upon the basis used, the cost of the article can vary between 30/- and 51/8. It is necessary, therefore, to analyse the various figures to see what amount can be taken as being the correct cost figure. If the Normal Capacity of 1,500 units is adopted, then the total cost per unit is 38/4, but if the Sales demand does not exceed 750 and production coincides with sales it would mean that only £500 of the £1,000 has been absorbed in costs, and the other £500 is a loss to be taken up as a deduction from profit.

In this case Normal Capacity has been taken as 75% of Practical Capacity, and the unit figure resulting was 38/4. If, however, Normal Capacity is placed at 80% of Practical Capacity, the expense rate would be 12/6 against 13/4, and the total unit cost would be 37/6, instead of 38/4. Similarly, if Normal Capacity is treated as 60% of Practical Capacity, the expense unit rate increases from 13/4 to 16/8, and the unit cost is accordingly increased to 41/8. If these figures are used in an attempt to fix selling prices, it is obviously necessary to be most careful in fixing the capacity to be adopted. Obviously, if Current Sales Capacity is adopted, the cost would be shown as 51/8, and the selling price may then be fixed at such a figure that there would be a further downward trend in sales. On the other hand, if the Total Capacity figure was used the selling price may be fixed at such a figure as would show a loss if the actual sales did not nearly reach such a total.

In the foregoing example, no reference has been made to the amount of expense, except as a single figure. Usually, however, this would be made up of two factors—fixed expense and variable expense. As explained in previous chapters, the fixed expense would be constant, and the variable expense would change according to output.* In the example previously given, it could be assumed that of the total expense to be absorbed (viz., £1,000), £500 would be Fixed and £500 Variable, at Normal Capacity. This would mean in effect, that the expense cost per unit would be 6/8, plus £500 spread amongst the units produced. Under these circumstances the expense rates would be:—

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*See also Scott's "Business Budgeting and Budgetary Control," pp. 237-239.

	Variable	Fixed	Total
Total Capacity	6/8 plus	2/6 —	9/2
Practical Capacity	6/8 „	5/- —	11/8
Normal Capacity	6/8 „	6/8 —	13/4
Normal Sales Capacity	6/8 „	10/- —	16/8
Current Sales Capacity	6/8 „	13/4 —	20/-

As mentioned above, unfortunately no standard nomenclature has been developed in relation to the various capacities and the terms used above have been adopted mainly bcause it is felt that they best suit the condition to which they have been applied. The one real exception is the term "Normal Capacity."

Normal Capacity.

In 1921, the National Association of Cost Accountants of America discussed fully many of the phases of normal capacity, and endeavoured to arrive at some uniformity of outlook. Finally, they defined "normal capacity" in the following terms:—

> " The normal capacity basis is the total possible time (that means any kind of work, machine or other) less reasonable allowance for break-downs, repairs, inefficiency, reasonable lack of operators, and all other regular normal delays, outside lack of orders to run on."
>
> (1921 Year Book, National Association of Cost Accountants.)

Normal capacity according to this definition refers to the manufacturing aspect.

The following factors are relevant when expense is applied to production at rates based on the normal capacity to manufacture:—

1. At any activity production is charged with:—
   (a) the amount of variable expense budgeted for that activity, and
   (b) the amount of fixed expense applicable to the capacity used.
2. The expense is exactly absorbed only when the actual activity corresponds exactly with the normal capacity to manufacture and the actual expenses are exactly in line with those budgeted for.
3. Where these conditions do not apply, the following variations may occur:—
   (a) the fixed expense may be exactly absorbed and the variable expense either under or over absorbed.
   (b) the variable expense may be exactly absorbed, and the fixed expense either under or over absorbed.
   (c) the fixed expense may be over-absorbed, and the variable expense may be under-absorbed.
   (d) the fixed expense may be under-absorbed, and the variable expense over-absorbed.
   (e) both fixed and variable expense may be under-absorbed.
   (f) both fixed and variable expense may be over-absorbed.
4. Fixed expense is over-absorbed only when actual activity is greater than at normal capacity to manufacture.

It should be noted that the total fixed expense absorbed shows the relationship between actual activity and that based on normal capacity.

If an organisation operates at three quarters of normal capacity, three quarters of the fixed expense would be absorbed and one quarter would be un-absorbed.

Normal capacity is sometimes taken to mean normal capacity to make and sell.

In such a case, the following factors would operate:—

1. At any rate of activity, production would be charged with:—
   (a) that part of the total fixed expense applicable (and based on the actual activity, as compared with the activity at normal capacity to make and sell), and
   (b) the amount of variable expense budgeted for at activity based on such normal capacity.
2. The expense is exactly absorbed only if the actual expenses are exactly in line with those budgeted for, and the actual activity is exactly in line with that based on the normal capacity.
3. Similar variations may take place as those outlined in connection with normal capacity to manufacture, viz.:—

   Fixed expense may be either under or over absorbed, as may also be variable.
4. Fixed expense is over-absorbed when the actual activity is above the base activity, and under-absorbed when actual is below base activity.
5. Variable expense may be under or over absorbed depending upon the relationship between the budgeted expense and the actual expense.

It is difficult to say which of these two rates should be adopted and the matter is really one for individual choice. Strong arguments can, however, be made for the use of an expense rate based upon normal capacity to manufacture:—

1. The unit cost derived under this method is as true a cost as it is practicable to obtain. It is not affected by expenditures resulting from idle capacity, and which therefore did not arise within the product itself. The use of basic units of cost facilitates decisions regarding parts or products which should be bought rather than made or vice versa, and, furthermore, give valuable information relating to policies and practices to meet competition.
2. Stocks of Goods in Process and of Finished Goods are not inflated by expenditures arising from unused capacity. This tends to avoid any possible inflation of assets in the balance sheet.
3. This method makes possible an analysis of the under or over absorbed expense to set forth the fixed expense arising from unused or excessively used capacity. These factors in turn lead to important managerial information.

The choice of rates, that is, between Normal Capacity to make and Normal Capacity to make and sell is frequently made on a basis of expediency. In choosing any such rate it should be remembered that it is the fixed expense which must be examined, inasmuch as the variable expense receives the same treatment under the two methods. The expense variation covering variable expense is merely the difference between actual expenditure and expenditure budgeted for at the adopted activity.

Obviously,·unabsorbed fixed expense must sooner or later be recovered through the price of the goods sold, but this does not necessarily mean that it must be included in the cost of goods produced. Rather is there a strong argument in favour of seeing that it is treated as a deduction from the price obtained for the goods.

Differences in Normal Rates.

The following examples will illustrate the difference between the Normal Capacity to Manufacture Rate and the Normal Capacity to Make and Sell.

The following figures are assumed:—

% of Normal Capacity to Manufacture	100%	90%	75%	50%	25%
Fixed Expenses	£10,000	£10,000	£10,000	£10,000	£10,000
Variable Expense	20,000	18,000	15,000	10,000	5,000
Total Expense	£30,000	£28,000	£25,000	£20,000	£15,000
Activity in Hours	20,000	18,000	15,000	10,000	5,000

Normal Capacity to Manufacture Rate—

Fixed Expense ... ... £10,000 divided by 20,000 hours — 10/- per hour.
Variable Expense ... ... £20,000 divided by 20,000 hours — 20/- per hour.

Total ... ... £30,000 divided by 20,000 hours — 30/- per hour.

Thus, the Fixed Expense Rate is 10/- per hour, and the Variable Expense Rate 20/- per hour.

Normal Capacity to Make and Sell Rate—

Assume that this is based upon an ability to Make and Sell of 15,000 hours, that is 75% of Normal Capacity to Manufacture Rate.

Fixed Expense Rate ... ... £10,000 divided by 15,000 hours — 13/4 per hour.
Variable Expense Rate... ... £15,000 divided by 15,000 hours — 20/- „ „

£25,000 15,000 hours — 33/4 per hour.

Thus, the Fixed Expense Rate in this case is 13/4 per hour, and the Variable Expense Rate is 20/- per hour. It should be specially noted that it is the Fixed Expense Rate which alters, not the Variable Expense Rate.

If a job took 100 hours, the apportionment of Expense would be :—

Normal Capacity to Manufacture—100 hours @ 30/- per hour £150 0 0
Normal Capacity to Make and Sell—100 hours @ 33/4 „ „ £166 13 4

The following examples will illustrate the effect of the two rates:—

1. Assume an Actual Expense of £26,000 with an activity of 15,000 hours.

Normal Capacity to Manufacture—

FACTORY EXPENSE A/c.

To Outgoing	£26.000	By Apportionment— 15,000 hrs. @ 10/- Fixed Expense Rate...	7,500
		15,000 hrs. @ 20/- Variable Expense Rate.	15,000

This would leave an under-absorption of £3,500, made up of :—

(a) Idle Capacity—5,000 hours @ 10/- Fixed Expense Rate £2,500
(b) Amount Over-Spent 1,000

£3.500

The amount of the under-absorption on Fixed Expense can also be obtained by taking the total fixed expense of £10,000 and deducting the amount absorbed £7,500, leaving un-absorbed £2,500.

Normal Capacity to Make and Sell—

FACTORY EXPENSE A/c.

To Outgoings	£26,000	By Apportionment— 15,000 hrs. @ 13/4 Fixed Expense Rate...	10,00
		15,000 hrs. @ 20/- Variable Expense Rate...	15,000

This would leave an under-absorbed amount of £1,000, which would be due to the amount over-spent. There would be no loss due to idle capacity.

2. Assume that the amount of expense was £24,000 for the same number of hours The relative figures would be:—

Normal Capacity to Manufacture—

FACTORY EXPENSE A/c.

To Outgoings	£24,000	By Apportionment— 15,000 hrs. @ 10/- Fixed Expense Rate...	7,500
		15,000 hrs. @ 20/- Variable Expense Rate...	15,000

The amount of under-absorbed expense would in this case be £1,500, made up of:—

Fixed Expense Un-absorbed, due to Idle Capacity—5,000 hrs. @ 10/- per hr.	2,500
Less Factory Expense under-spent	1,000
Net Variation	£1,500

Normal Capacity to Make and Sell—

FACTORY EXPENSE A/c.

To Outgoings	£24,000	By Apportionment— 15,000 hrs. @ 13/4 per hr. Fixed Expense Rate... ...	10,000
		15,000 hrs. @ 20/- per hr. Variable Expense Rate ...	15,000

The amount over-absorbed is £1,000, the Factory Expense being under-spent to this extent.

3. Assume an amount of £22,000, with an activity of 10,000 hours.

Normal Capacity to Manufacture—

FACTORY EXPENSE A/c.

To Outgoings	£22,000	By Apportionment— 10,000 hrs. @ 10/- per hr. Fixed Expense Rate... ...	5,000
		10,000 hrs. @ 20/- per hr. Variable Expense Rate ...	10,000

The amount under-absorbed is £7,000, made up of:—

Under-absorbed Fixed Expense, due to Idle Capacity...	£5,000
Amount over-spent...	2,000
	£7,000

Normal Capacity to Make and Sell—

FACTORY EXPENSE A/c.

To Outgoings	£22,000	By Apportionment— 10,000 hrs. @ 13/4 per hr. Fixed Expense Rate ...	6,666 13 4
		10,000 hrs. @ 20/- per hr. Variable Expense Rate...	10,000 0 0

This leaves an under-absorbed amount of £5,333 6 8, of which £3.333 6 8 is due to under-absorbed Fixed Expense, owing to Idle Capacity, and an amount of £2,000 over-spent.

Consideration of Rates.

From the foregoing it will be seen that the Factory Expense per unit was 30/- in the case of the Normal Capacity to Manufacture and 33/4 with the Normal Capacity to Make and Sell. The question naturally arises as to which rate should be used. Before any decision is made in this connection, advocates of each rate would jointly agree that all idle equipment—equipment really idle—should be segregated in point of expense. The remainder of the equipment is capable of a certain manufacturing output. If this output can also be sold, then the two rates are calculated on the same basis, and the rate agreed upon would be the same in each case. If, however, the capacity to manufacture exceeds the capacity to sell the problem is to what expense the inability of the sales department should be allowed to increase costs of manufacture. On the one hand, the Normal Capacity to Manufacture Rate deals in terms of manufacturing capacity, and the Normal Capacity to Make and Sell Rate assumes something in the nature of an arbitrary figure as a basic ability to make and sell. Thereafter the two methods calculate Idle Capacity in the same way.

In addition to the arguments already given in favour of the Normal Capacity to Manufacture Rate, there are further advantages:—

1. The sales department is assisted by the quotation of lowest possible rates. The fixed expense is spread over a greater number of units, the cost is lower, and, possibly, the selling price is lower.
2. This is the easier rate to calculate. It is usually much simpler to estimate capacity to manufacture than capacity to make and sell. There is therefore more certainty in dealing with the figures.
3. There is less necessity to change, because manufacturing capacity is changed much less frequently and generally only because of special conditions, as, for example, if capacity to sell reached capacity to manufacture and in order to keep pace with extra sales demands, plant had to be increased, or, alternatively, if it was decided to scrap some of the machines and not replace them.
4. The under-absorbed expense definitely represents the manufacturing capacity not used.

These are strong advantages, and the disadvantages are few, but one of them is very important.

When Normal Capacity to Manufacture is adopted, this represents the maximum capable of being realised. In the majority of cases, it will not be realised, and in times of depression the variance may be very great. Thus, a cost may be given, but because of the under-absorbed capacity the loss may be very great, and there may be a tendency to overlook the fact that this loss is occurring, and that the costs given for products have ignored this factor.

This disadvantage is strong enough to ensure a thorough consideration of the Normal Capacity to Make and Sell Rate, and usually the capacity to sell is definitely taken into account in fixing the rate. With the increasing use of budgets, additional information becomes available, and this may be very valuable in fixing the capacity upon which the rate is to be based. Where the budget approximates normal capacity, a budgeted rate may be struck and this may be used.

DEPARTMENTAL EXPENSE RATES.

In the foregoing, consideration has been given to the business as a whole. Similar problems to those enumerated above, however, also exist in relation to departments. In some ways there are additional problems, as, for example:—

1. Different departments within the same business may have totally different capacities.
2. Some departments may be dependent upon others, whilst some may be quite independent.
3. Idle equipment in some departments may demand special treatment.

Departmental Capacity.

The first question for consideration is whether a capacity fixed upon for a business should be applied to every department. This will depend upon circumstances, but as a rule it is wise to consider each department on its merits. Some departments may have varying capacities, but may be inter-dependent and obviously real capacity to produce will depend upon the capacity of any bottle-neck department. Under these circumstances, the bottle-neck may require careful consideration and may be the most important factor in deciding the capacity for each department. Thus, if the Finishing Department is dependent upon the output of the Machining Department, even if the capacity of the former is much greater than that of the latter, the two departments may have to be considered in the light of the capacity of the Machining Department. The Machining Department in turn may be dependent upon the Knitting Department.

Some of the departments may, however, be independent of the others and this factor must also be given special consideration. For example, the Knitting Department may have a capacity which will much more than keep the Machining Department fully engaged. It may, however, be possible to obtain outside orders for knitted cloth, and in this case two factors would need consideration—firstly, whether the capacity of the Knitting Department should be calculated in terms of total manufacturing capacity, or whether it should be interpreted in regard to the requirements of the Machining Department, plus selling capacity for outside purchasers. The rules guiding the consideration of these factors are the same as those already enumerated in relation to the business as a whole.

Where any department obviously has idle capacity in the form of machines which are not required, the expense relating thereto should be segregated in the first instance.

Service Departments.

The second question arises in connection with the use of fixed and variable rates governing the application of Service Expense to Departments. The usual method is to divide the total expense proportionately amongst the various departments according to the services used. A much more accurate approach, however, takes into account the total of the services available to each department, as well as the services used. The following example, will illustrate this aspect:—

Use of Single and Dual Rates.

An organisation decides to set up a Canteen, and makes careful inquiries as to the number of employees in each department, and from this the number of meals which the canteen must be prepared to serve. After careful investigation it is decided that the number of meals over a period would be:—

Department 1. 12,000
„ 2. 8,000
„ 3. 4,000. The Fixed Expense involved in these meals is £600, and the Variable Expense at the rate *of 1/- per meal is £1,200. On the basis of this number of* meals the expenses may be divided as under:—

Department 1.	$\frac{12,000}{24,000} \times$ £1,800	£900
„ 2.	$\frac{8,000}{24,000} \times$ £1,800	£600
„ 3.	$\frac{4,000}{24,000} \times$ £1,800	£300
		£1,800

A more correct approach can be obtained by the use of separate rates for Fixed and Variable expense, as, for example:—

Department 1.

Fixed	$\frac{12,000}{24,000} \times$ 600	£300
Plus Variable	$\frac{12,000}{24,000} \times$ 1,200	£600
	Total	£900

Department 2.

Fixed	$\frac{8,000}{24,000} \times$ £600	£200
Plus Variable	$\frac{8,000}{24,000} \times$ 1,200	£400
	Total	£600

Department 3.

Fixed	$\frac{4,000}{24,000} \times$ £600	£100
Plus Variable	$\frac{4,000}{24,000} \times$ 1,200	£200
		£300

The following variations of the foregoing should be noted:—

1. All departments are reduced to half capacity, which would mean:—

Department 1		6,000 meals
„ 2		4,000 „
„ 3		2,000 „
The expense would be—	Fixed Expense	£600
	Variable Expense	£600
		£1,200

By the use of a single rate, the apportionments to departments would be:—

Department 1.	$\frac{6,000}{12,000} \times$ £1,200	£600
„ 2.	$\frac{4,000}{12,000} \times$ £1,200	£400
„ 3.	$\frac{2,000}{12,000} \times$ £1,200	£200
	Total	£1,200

By the application of fixed and variable rates, the position would be:—

Department 1.		
Fixed	$\frac{12,000}{24,000} \times$ 600	£300
Plus Variable	$\frac{6,000}{12,000} \times$ £600	£300
	Total	£600
Department 2.		
Fixed	$\frac{8,000}{24,000} \times$ £600	£200
Plus Variable	$\frac{4,000}{12,000} \times$ £600	£200
	Total	£400
Department 3.		
Fixed	$\frac{4,000}{24,000} \times$ £600	£100
Plus Variable	$\frac{2,000}{12,000} \times$ £600	100
		£200
	Total for all Departments	£1,200

It will be noted from the above illustration that there is again no difference between the single rate and the double rates, but this is entirely due to the fact that the proportionate reduction in relation to each department is the same, viz., 50%.

2. Assume that there is a fall from 24,000 meals to 12,000 meals, but the proportion varies in each department:—

Department 1.	7,000 meals
„ 2	3,000 meals
„ 3	2,000 meals

The total expense would again be:—

Fixed Expense	£600
Variable Expense	£600
	£1,200

By the single rate method, the position would be:—

Department 1. $\frac{7,000}{12,000} \times 1,200$	£700
„ 2. $\frac{3,000}{12,000} \times 1,200$	£300
„ 3. $\frac{2,000}{12,000} \times 1,200$	£200
	£1,200

The use of double rates shows:—

Department 1.	
Fixed $\frac{12,000}{24,000} \times £600$	£300
Plus Variable $\frac{7,000}{12,000} \times £600$	£350
	£650
Department 2.	
Fixed $\frac{8,000}{24,000} \times £600$	£200
Plus Variable $\frac{3,000}{12,000} \times £600$	£150
	£350
Department 3.	
Fixed $\frac{4,000}{24,000} \times £600$	£100
Plus Variable $\frac{2,000}{12,000} \times £600$	£100
	£200
Total for all Departments	£1,200

It will be seen from the foregoing, that there are discrepancies for Departments 1 and 2, whilst Department 3 is the same in both cases. In the single rate method, Department 1 shows £50 more than under the double rates method, whilst Department 2 shows £50 less. The adoption of the double rates method charges to Department 2 the correct amount of expense for which it is liable. It takes into account the expense that has accrued because of the fact that Department 2 has not called upon the canteen for the number of meals for which the canteen was set up.

3. Assume the following figures:—

Department 1.	9,000
„ 2.	3,000
„ 3.	4,000

The expense involved would be:—

Fixed Expense	£600
Variable Expense (16,000 meals at 1/)	£800
	£1,400

Under the single rate method the appropriation would be:—

Department 1.	$\frac{9,000}{16,000} \times$ £1,400	£787	10	0
Department 2.	$\frac{3,000}{16,000} \times$ £1,400	£262	10	0
Department 3.	$\frac{4,000}{16,000} \times$ £1,400	£350	0	0
		£1,400	0	0

Using the double rates, the position is:—

Department 1.					
Fixed	$\frac{12,000}{24,000} \times$ 600	£300			
Plus Variable	$\frac{9,000}{16,000} \times$ £800	£450			
			£750	0	0
Department 2.					
Fixed	$\frac{8,000}{24,000} \times$ £600	£200			
Plus Variable	$\frac{3,000}{16,000} \times$ £800	£150			
			£350	0	0
Department 3.					
Fixed	$\frac{4,000}{24,000} \times$ £600	£100			
Plus Variable	$\frac{4,000}{16,000} \times$ £800	£200			
			£300	0	0
	Total all Departments		£1,400	0	0

It should be noted in this illustration that with the single rate Department 3 has to bear £50 more than was apportioned to it in the original example, though the number of meals is exactly the same. With the double rates method, the amount asked of Department 3 is exactly the same as it was when the rates for 24,000 meals were worked out, because it was apportioned £300 for 4,000 meals, and it has required its full 4,000. Department 2, however, required 8,000 meals, for which it was to pay £600, and actually took only 3,000 meals. Under the single rate method its expense was £262/10/-, but under the double rates £350. It should also be noted that with the double rates method, the amount charged to Department 2 for 3,000 meals is £50 more than that charged to Department 3 for 4,000 meals. This, of course, shows up the operation of the Idle Capacity.

This principle can be extended to various service departments and actually extends the principle of responsibility for Idle Capacity expense between departments in the way in which it ordinarily acts in relation to the whole of the business.

Conclusion.

One of the most difficult decisions before any cost accountant is to decide what is to be taken as Normal Capacity. It is interesting to note in this connection that in a questionnaire directed by the National Association of Cost Accountants, U.S.A., in relation to the practice in applying overhead and calculating normal capacity, 89 out of 172 companies based this upon the ability to produce and sell, 34 on ability to produce, 44 on estimated production based on ability to produce and sell, and 5 only on estimated production based on ability to produce only. Of the 89 which used ability to produce and sell, 27 took as the major factor the practical capacity of the whole plant, 25 the anticipated sales for the period under review, 21 the average sales experience for a number of past years, 11 the anticipated sales for a number of years in the future, and 5 the practical capacity of the department with the least capacity (N.A.C.A. Research Study, April 1st, 1938).

No general rule can be laid down. The cost accountant should examine the individual circumstances operating in the business under review and decide upon the one which is most appropriate to that particular organisation.

CHAPTER 32.

PROFIT FACTORS AND DIFFERENTIAL COSTS.

It is incumbent upon the cost accountant to have a very clear conception of all factors affecting profit. This is essential because the whole of his work is aimed at conserving or increasing profits, and a knowledge of all the factors affecting such is therefore imperative. One of the most important factors is the interplay of fixed and variable expense and the relationship which these matters bear to the profit situation.

Taking these two broad divisions—fixed and variable expense—it can be said that the sales price of a commodity is made up of Fixed Expense, plus Variable Expense, plus Profit (or minus Loss). This can be expressed somewhat differently by saying that the difference between sales value and the variable cost represents the contribution to fixed cost and profit. Thus, if a commodity is sold for £2/10/-, and its variable cost is £1/10/-, the remaining amount of £1/-/- has to cover the fixed charges applicable to that product, and if it does more than this, the difference represents profit. If the £1/-/- is not sufficient, then a loss has been incurred. This subject has been pursued at some length by the author in "Business Budgeting and Budgetary Control," and the following extract is taken from that book :—

"Break Even Point."

It is possible to extend this principle to ascertain the amount of turnover required to cover the total amount of expense, or to make a certain pre-arranged profit. The amount of turnover necessary in order that there shall be neither profit nor loss is termed the 'Break Even Point.' Where a business has a turnover of £250,000 per year, its fixed cost representing £50,000, and its variable cost percentage equalling 70%, the profit should amount to £25,000. This is arrived at in the following manner.

Total Sales		£250,000
Less Fixed Cost	50,000	
Less Variable Cost (70% of £250,000)	175,000	225,000
Profit		£ 25,000

To find the break even point, it is necessary to multiply the amount of the fixed cost charges by 100, dividing by the percentage which the fixed charges represent to the whole. Thus, in the case given above, the fixed charges £50,000 should be multiplied by 100 and divided by 30, because variable cost is 70 per cent. The break even point is therefore the quotient £166,666/13/4. This answer can be proved as under:—

Fixed Costs	£ 50,000	0	0
Variable Cost (70% of £166,666 13 4)	116,666	13	4
Total of Sales	£166,666	13	4

No clearer view of the effect upon a business of the ratio existing between fixed and variable costs can be obtained than through the illustration of various examples. In the case already given, if the fixed cost could be reduced to £40,000, the break even point would be £40,000, multiplied by 100, divided by 30, equalling £133,333/13/4.

If the fixed cost remained at £50,000, but the variable cost was reduced to 60 per cent., the break even point would be £50,000, multiplied by 100 divided by 40, equalling £125,000, as in this case fixed costs would represent 40%.

Ascertaining the Amount of Profit.

The same formula can be applied to ascertain the profit or loss likely to be made on any volume of turnover. Returning to our original example of a fixed cost of £50,000, and a variable cost of 70 per cent., we are able to tell what profit or loss there would be in the case of a turnover of, say, £300,000.

Fixed Cost	...£ 50,000
Variable Cost (70% of £300,000)	210,000
	£260,000
	Profit Equals—£40,000

The effect which percentages of fixed and variable costs have upon profits at varying turnovers is best shown as under. Four businesses are each making £3,000 profit The particulars in relation to each business are:—

Percentage contributed to Fixed Cost and Profit:—

Business No. 1	20%
,, ,, 2	30%
,, ,, 3	40%
,, ,, 4	50%

	No. 1	No. 2	No. 3	No. 4
Variable Cost	£24,000	£21,000	£18,000	£15,000
Fixed Cost	3,000	6,000	9,000	12,000
Profit	3,000	3,000	3,000	3,000
Sales	30,000	30,000	30,000	30,000

Though each business has made £3,000 on a turnover of £30,000, the difference in the ratios of fixed and variable costs means that there is a different break even point in each case. Thus:—

BREAK EVEN POINT

	No. 1	No. 2	No. 3	No. 4
Variable Cost	£12,000	£14,000	£13,500	£12,000
Fixed Cost	3,000	6,000	9,000	12,000
Profit	Nil	Nil	Nil	Nil
Turnover	15,000	20,000	22,500	24,000

The above illustration shows that because in No. 1 business the fixed cost is only 20 per cent., the amount of sales necessary to break even is only £15,000. In the case of No. 4, the fixed cost reaches 50 per cent., and it is necessary to obtain £24,000 worth of sales in order that all costs may be recovered. It is now possible to gauge the effect of decreased or increased turnover in each of the above cases. If turnover falls to £25,000, the following position would be disclosed.

	No. 1	No. 2	No. 3	No. 4
Variable Cost	£20,000	£17,500	£15,000	£12,500
Fixed Cost	3,000	6,000	9,000	12,000
Profit	2,000	1,500	1,000	500
Turnover	25,000	25,000	25,000	25,000

In the event of a £15,000 turnover, the position would be :—

Variable Cost	12,000	10,500	9,000	7,500
Fixed Cost	3,000	6,000	9,000	12,000
Loss	Nil	1,500	3,000	4,500
Turnover	15,000	15,000	15,000	15,000

If, however, there was an increase in turnover to £40,000, the position would be:—

	No. 1	No. 2	No. 3	No. 4
Variable Cost	£32,000	£28,000	£24,000	£20,000
Fixed Cost	3,000	6,000	9,000	12,000
Profit	5,000	6,000	7,000	8,000
Turnover	40,000	40,000	40,000	40,000

As a rule to be followed, therefore, it can be stated that the best business is that with the lowest variable cost consistent with a break even point below the smallest volume of business which there is a reasonable probability of obtaining.

From the foregoing the following conclusions can be drawn:—

1. That the effect of increased turnover on profits is determined by the amount of fixed costs and the percentage of variable costs.
2. That better prices would frequently give more satisfactory results than increased turnover.
3. To increase profits it is necessary firstly to attempt a reduction of fixed costs and secondly, a reduction of the percentage rate of variable expense."

Profit Control Charts.

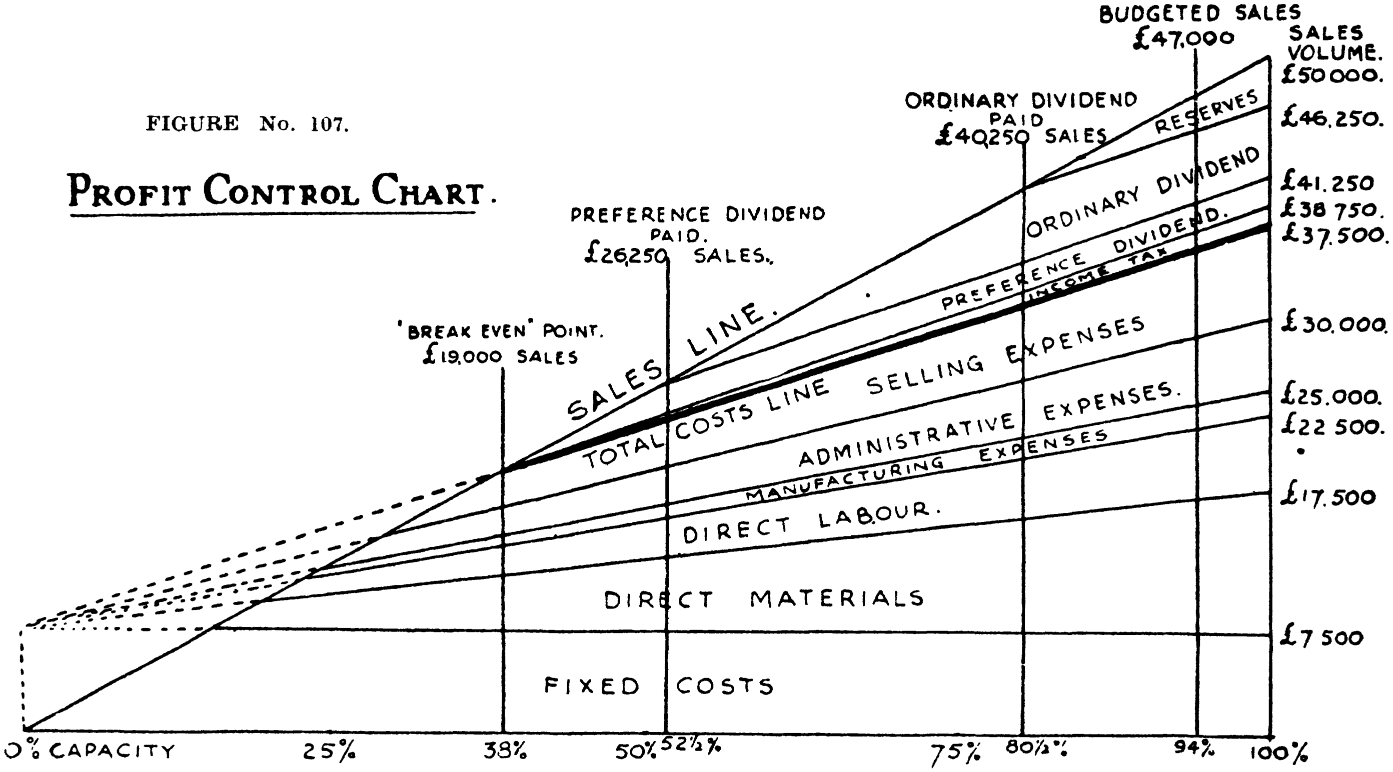
Figure No. 107 shows a Profit Control Chart which sets out the vital factors in a business. From this it will be seen that the break even point of the business is at 38% capacity, representing £19,000 in sales, whilst 100% capacity would yield a sales volume of £50,000. Sales amounting to £26,250 are necessary to pay the preference dividend and £40,250 to cover the ordinary dividend. The fixed costs are £7,500 throughout, and the total variable expense is 12/- in the £, amounting to £30,000 for £50,000 sales volume. The amounts contributed to variable expense by Direct Materials, Direct Labour, Manufacturing Expenses, Administrative Expense and Selling Expense are shown. Out of profits, income tax is first appropriated then Preference Dividend, Ordinary Dividend, then Appropriation to Reserves.

It will be easy to see how valuable a chart of this kind can become, as once the amount of fixed cost and variable expenses are known, it is possible to arrive at the sales turnover required to cover any or all of the expenses plus any required profit. Its uses can be set down as under:—

1. To compare sales, costs and profits for any turnover.

FIGURE No. 107.

PROFIT CONTROL CHART.



2. To determine the amount of sales necessary in order to break even, to pay preference dividends, to pay ordinary dividends or to procure any specific amount of profit.
3. To compare probable earnings of different businesses.
4. To arrive at the total increase in sales necessary to justify extra capital expenditure for, say, plant extension.
5. To determine the amount of increase in sales necessary to balance a specific reduction in selling prices.
6. To estimate the effect upon profits of changes in wages costs, materials cost or some other such factor.
7. To determine whether a large order at a cut price would be worth while.
8. To determine probable unit costs at varying levels of production.

Calculation of Turnover Required.

With a knowledge of the desired profit, it is possible to work back to ascertain the amount of turnover necessary in order to produce such profit. A company with a capital of £500,000 desires to pay an 8 per cent. dividend, to be able to set aside £10,000 for taxation reserve and £20,000 for general reserve. The total amount of profit necessary is therefore £70,000. It is known that the fixed charges amount to £100,000 and variable cost percentage is 80%. This would mean, therefore, that the total profit, plus fixed charges (£70,000, plus £100,000, equals £170,000) equals 20%. The turnover (100%) would therefore be £850,000. The position would actually be:—

Fixed Cost	£100,000	
Variable Cost	680,000	(80%)
Profit...	70,000	
Turnover	£850,000	

Other Profit Calculations.

The following factors relating to profit can be calculated from information which includes the amounts of fixed and variable expenses.

1. *Effect of Increase or Decrease in Volume.*

	Base	25% *Increase*	50% *Increase*	25% *Decrease*
Sales	£100,000	£125,000	£150,000	£75,000
Variable Cost	72,000	90,000	108,000	54,000
	28,000	35,000	42,000	21,000
Fixed Cost	21,000	21,000	21,000	21,000
Profit	£ 7,000	£14,000	£21,000	Nil

2. *Effect of Increased Fixed Cost and Decreased Variable Cost.*

Assume Fixed Cost £3,300. Variable Cost £60,000 as base figures.

	Base	25% *Increase*	50% *Increase*	25% *Decrease*
Sales	£100,000	£125,000	£150,000	£75,000
Variable Cost	60,000	75,000	90,000	45,000
	40,000	50,000	60,000	30,000
Fixed Cost	33,000	33,000	33,000	33,000
Profit or Loss	£ 7,000	£17,000	£27,000	£3,000 (Loss)

3. *Effect of Increase or Decrease in Sales Price.*

	Base	10% *Plus*	10% *Less*
Sales	£100,000	£110,000	£90,000
Variable Cost	72,000	72,000	72,000
	28,000	38,000	18,000
Fixed Cost	21,000	21,000	21,000
Profit or Loss	£ 7,000	£17,000	£ 3,000 (Loss)

4. *Effect of Increase or Decrease in Variable Cost.*

	Base	*Minus* 5% *Variable Cost*	*Plus* 5% *Variable Cost*
Sales	£100,000	£100,000	£100,000
Variable Cost	72,000	68,400	75.600
	28,000	31,600	24,400
Fixed Cost	21,000	21,000	21,000
Profit or Loss	£ 7,000	£10,600	£ 3,400

5. *Effect of Increase or Decrease of Fixed Cost.*

	Base	*Minus* 5% *Fixed Cost*	*Plus* 5% *Fixed Cost*
Sales	£100,000	£100,000	£100,000
Variable Cost	72,000	72,000	72,000
	£ 28,000	28,000	28,000
Fixed Cost	21,000	20,000	22,000
Profit	£ 7,000	£ 8,000	£ 6,000

6. *Alternatives Available to Double Profits.*

It is desired to double the profit and the following illustration shows that this can be achieved by concentration upon any one of the four factors shown hereunder:—

	Base	*Volume* *V.*+25%	*Price* *P.*+7%	*Variable Cost* *V.*−10%	*Fixed Cost* *F.C.*−33⅓%
Sales	£100,000	£125,000	£107,000	£100,000	£100,000
Variable Cost ...	72,000	90,000	72,000	65,000 (say)	72,000
	28,000	35,000	35,000	35,000	28,000
Fixed Cost ...	21,000	21,000	21,000	21,000	14,000
Profit	£ 7,000	£14,000	£14,000	£14,000	£14,000

Factors similar to the foregoing can be calculated in a somewhat different manner, as can be seen from the following examples:—

Example 1.

A business operates with a fixed expense of £110,000 at 80% capacity, which gives a turnover of £400,000. The variable expense at this turnover is £240,000. What is the break even point of the business?

$$\text{Sales}: \frac{110{,}000}{1 - \dfrac{240{,}000}{400{,}000}} = \frac{110{,}000}{0.4} = £275{,}000$$

Example 2.

A business operates with a fixed expense of £70,000 and the ratio of variable expense to sales is 0.35. (a) What profit should be earned from a turnover of £120,000?

$$\text{Profit}: \pounds120{,}000\ (1 - 0.35) = \pounds70{,}000 \text{ equals}$$
$$\pounds78{,}000 - \pounds70{,}000 = \underline{\underline{\pounds8{,}000}}$$

(b) What turnover is required to double this profit?

$$\text{Sales}: \frac{\pounds16{,}000 \text{ plus } \pounds70{,}000}{1 - 0.35} = \pounds132{,}307$$

(c) At what turnover will the business break-even?

$$\text{Sales}: \frac{\pounds70{,}000}{.65} = \pounds107{,}692.$$

Example 3.

A product sells for 10d. per lb. The fixed costs are £50,000 and the variable expense applied to sales is 0.4. What would the unit cost be when the sales are £100,000 ?

$$\text{Unit Cost}: \frac{50{,}000}{100{,}000} \times 10\text{d. Plus } (.4 \times 10\text{d.})$$
$$\text{equals 5d. plus 4d.} = 9\text{d.}$$

Differential Costs.

Differential Costs may be defined as that increase in the total cost which arises from an increase in the volume of production. The distinction between the total cost and the manufacturing cost should be noted, as distribution, selling and administrative costs have an important bearing upon differential costs.

If 5,000 units could be produced and sold for £5,000, and 7,500 units could be produced and sold for £6,500, the differential cost of the last 2,500 units would be £1,500. The unit cost of the first 5,000 would be £1 per unit, and of the last 2,500 12/- per unit. The differential cost would therefore be 12/-. The decreased unit rate for the last 2,500 units arises from the fact that the latter would be produced after the fixed costs had been borne by the first 5,000.

This is shown in the following example:—

The cost of the 5,000 units is £5,000, made up of

Fixed Cost	£2,000	
Variable Cost	£3,000	
		£5,000

The cost of 7,500 units is made up of:—

Fixed Cost	£2,000	
Variable Cost	4,500	
		£6,500

From this example, the following important principle can be observed —Providing that all the expenses can be divided primarily into Fixed and Variable, and that the Fixed are solely Fixed, and the Variable truly and directly so, Differential Cost is the same as the unit Variable Cost.

In the example given, it will be noted that as all the Fixed charges have been absorbed, the cost of the extra 2,500 units is 2,500 x 12/- = £1,500, which added to the previous cost of £5,000, gives the figure of £6,500, for 7,500 units.

Differential Costs can be worked out for varying capacities as shown hereunder:—

Capacity	40%	50%	60%	80%	100%
No. of Units	8,000	10,000	12,000	16,000	20,000
Total Fixed Costs	£8,000	£8,000	£8,000	£8,000	£8,000
Unit cost of Fixed Charges	20/-	16/-	13/4	10/-	8/-
Variable Costs	£8,000	£10,000	£12,000	£16,000	£20,000
Unit cost of Variable Charges	20/-	20/-	20/-	20/-	20/-
Total Unit Cost Fixed & Variable	40/-	36/-	33/4	30/-	28/-

The Differential Cost is 20/- per unit, which is the same as the variable cost. Thus, if the organisation was producing 8,000 units and was able to step up to 10,000, the Differential Cost would be £2,000. If the 8,000 units had been sold for £16,000 and the rates given above included all expenses, the business would break even, because the total cost would be £8,000 Fixed Expense, and £8,000 Variable Expense. If the 10,000 units could also be sold for £2, the net proceeds to the business would be £20,000, and the total costs £18,000 (Fixed £8,000, Variable £10,000) leaving a profit of £2,000.

Effect of Increased Sales.

Knowledge of this principle is very valuable where a business is asked to take on extra production at a cut rate.

For example, this organisation may be producing 12,000 units at the total cost of £20,000 (Fixed Cost £8,000, Variable Cost £12,000). The selling price of these units may be £2 per unit, giving gross receipts of £24,000, and leaving a profit of £4,000. It may be approached to produce a further 6,000 units at a selling price of £1/5/- per unit. The question is whether it should accede to the request. Actually in the above example, the extra profit is easily calculated by taking 6,000 units at 5/-, a total extra profit of £1,500. This would mean that the total profit of the business was increased from £4,000 to £5,500 by taking on the extra 6,000 units, and selling these at a discount of 37½% under the usual selling price.

The same result can be arrived at by working out the two sets of figures:—

12,000 units—Fixed Cost	£ 8,000	
Variable Cost	12,000	(12,000 units @ 20/- each)
	£20,000	
Selling Price—12,000 @ £2	24,000	
		Profit £4,000
18,000 units—Fixed Cost	£ 8,000	
Variable Cost	18,000	(18,000 units @ 20/- each)
	£26,000	
Selling Price	31,500	
		Profit £5,500
12,000 @ £2	24,000	
6,000 @ £1/5/-	7,500	

As stated previously, this principle operates providing firstly that the Fixed and Variable are truly Fixed and truly Variable, and secondly, providing that there is no change in either the Fixed amount or the Variable rate.

In the figures quoted previously the cost of 20,000 units, was £28,000, made up of:—

Fixed Cost	£8,000
Variable Costs—20,000 units @ 20/-	20,000
	£28,000

Assume again that the Selling price is £2. The profit would be £12,000. (£40,000 less £28,000). The organisation is again asked to take on 6,000 units extra at 25/- per unit, but 20,000 units is the total capacity of the plant, and in order to cater for the extra 6,000 units, it becomes necessary to increase the plant. This puts the Fixed Charges up from £8,000 to £12,000. The cost of the 26,000 units would therefore be:—

Fixed Cost	£12,000
Plus Variable Cost—26,000 units @ 20/-	26,000
	£38,000

The net profit would now be:—

£47,500 (20,000 units at £2, plus 6,000 units at 25/-), less Total Cost as shown above, £38,000 leaving a net profit of £9,500. Thus, by taking on the extra 6,000 units at 25/-, the net profit of the organisation has dropped from £12,000 to £9,500. If the extra 6,000 units could be sold at 33/4 per unit, the net result would leave the profit at its original figure of £12,000. Thus, unless at least 33/4 could be obtained, the organisation would be better off by refusing the offer. This would, however, be subject to the fact that the extra expenditure of £4,000 on the Fixed Charges may give to the organisation extra capacity to take up not only the extra 6,000 units, but perhaps an extra 10,000 or 12,000 units. This and other factors would have to be taken into account in dealing with the problem.

Sometimes the stage is reached when it would not pay the organisation to expand, even if sales could be made at existing selling prices. If, in the above example, the Fixed Charges had increased from £8,000 to £15,000 the cost of the 26,000 units would be £41,000 (Fixed Cost £15,000, Variable Cost £26,000). Under these circumstances, the net profit would fall from its original figure of £12,000, to an amount of £6,500. What is more important is to notice, that even if the 6,000 extra units had been sold at the existing selling price of £2 per unit, the net profit on the 26,000 units would still be smaller:—

£11,000 net profit for 26,000 units
as against £12,000 net profit for 20,000 units.

Here again the question of extra capacity available would be taken into account in arriving at decisions.

Differential Cost Studies.

Example 1.

The following illustration presents a differential cost study in relation to determination of policy and covering such factors as Volume and Price.

Expense	Shut Down Production	60% Capacity	80% Capacity	100% Capacity	120% Capacity	(Requiring additional facilities)
Fixed Costs—						
Factory Expenses ...	£7,500	£7,500	£7,500	£7,500	£11,500	
Warehouse Expenses	2,500	2,500	2,500	2,500	3,000	
Selling Expenses ...	3,750	3,750	3,750	3,750	4,500	
Admin. Expenses ...	8,750	8,750	8,750	8,750	12,000	
Total Fixed	£22,500	£22,500	£22,500	£22,500	£31,000	
Variable Costs—						
Materials		£1,500	£2,000	£2,500	£3,000	
Direct Labour ...		1,500	2,000	2,500	3,000	
Factory Expense ...		2,250	3,000	3,750	4,500	
Warehouse Expense		450	600	750	900	
Selling Expense ...		750	1,000	1,250	1,500	
Admin. Expense ...		300	400	500	600	
Total Variable—		£6,750	£9,000	£11,250	£13,500	
Total Costs	£22,500	£29,250	£31,500	£33,750	£44,500	
Additional Units Produced		600	200	200	200	
Differential Cost of Added Units ...		£11 5 0	£11 5 0	£11 5 0	£11 5 0	
Total Units Produced		600	800	1,000	1,200	
Average Cost per Unit		£48 15 0	£39 5 0	£33 15 0	£37 1 9	

Example 2.

This example shows the application of differential costs relating to Product Classes.

(a) This assumes an allocation of distribution costs as a percentage on turnover:—

Line	*Volume*	*Gross Profit*	*Distribution Cost*	*Net Profit*
"A"	£3,750	£1,500	£375	£1,125
"B"	2,500	750	250	500
"C"	18,750	2,750	1,875	875

(b) In this case, distribution costs are apportioned by acceptable costing surveys:—

Line	*Volume*	*Gross Profit*	*Distribution Cost*	*Net Profit or Loss*
"A"	£3,750	£1,500	£875	£625
"B"	2,500	750	875	125 L
"C"	18,750	2,750	750	2,000

The discontinuance of Line "B" is contemplated. From (a) it may be anticipated that there would be a loss of profit of £500. From (b) the estimate would be an extra profit of £125. The real position is, however, only disclosed by dissecting the fixed and variable expenses, viz.:—

Line	*Volume*	DIRECT COSTS		*Net Profit*
		Manufacturing	*Distribution*	
"A"	£3,750	£2,000	£875	£875
"B"	2,500	1,000	875	625
"C"	18,750	12,000	750	6,000
				£7,500
			Less Fixed Costs	5,000
			Net Profit	£2,500

Therefore, if Line "B" is discontinued, the real position will be:—

	"A"	"C"	Total
Sales	£3,750	£18,750	£22,500
Variable Costs	2,875	12,750	15,625
			£6,875
		Fixed Costs	5,000
		Net Profit	£1,875

Loss due to eliminating Line "B" is therefore £625.

Example 3.

Instead of spreading the Fixed Cost on the basis apparently used, viz.:

	A	B	C
(a) Marginal Income	£875	£625	£6,000
Fixed Cost Allocation	250	750	4,000
Net Profit or Loss	£625	£125(L)	£2,000

It may be felt that the basic product "C" should be charged with all the Fixed Costs, viz.:—

	A	B	C
Marginal Income	£875	£625	£6,000
Fixed Cost Allocation	—	—	£5,000
Net Profit	£875	£625	£1,000

Alternatively, it may be desired that any margin over the direct cost in the case of Products A and B should be used to reduce the Fixed Costs appropriated to C.

	A	B	C
Marginal Income	£875	£625	£6,000
Fixed Cost Allocation	875	625	3,500
	Nil	Nil	£2,500

It should be noted that if the Line B does not reduce the fixed costs, it can be sold profitably for any amount over and above the differential cost of its production.

Dumping.

The principle outlined above is an important one in any consideration of dumping. Here opportunity is taken of differential costs in placing on the market large quantities of produce at a lower price than the usual selling rate. Again using the figures on page 457, it will be followed that if this business was operating on 50% capacity, its net profit would be £2,000.

10,000 units at selling price £2 per unit, total		£20,000
Less Fixed Cost	£ 8,000	
Variable Cost	10,000	
		18,000
Profit		£2,000

It decides to dump 10,000 units in a foreign country at 25/- per unit. Its extra profit would be £2,000 (10,000 units 5/- representing the difference between the selling price 25/-, and the variable cost of 20/-). In a case like this, it must of course be remembered that the whole of the capacity (if the maximum capacity was 20,000 units) would have been taken up and no more would be available for the home market.

An attempt has been made in the foregoing pages to explain not only Differential Costs, but the effect which Fixed and Variable Cost proportions may have on profits. As explained at the outset it is essential that cost accountants should understand the principles underlying profit control and differential costs.

CHAPTER 33.

COST ACCOUNTING AS AN AID TO FOREMEN.

The work of a cost accountant automatically brings him into contact with the various foremen in the organization. It is frequently necessary for him to collaborate with a foreman when it is intended to make any change in records or procedure. Furthermore, in attempting to trace causes of variations in cost figures as well as innumerable queries which inevitably arise, he must consult with the foremen to obtain the information he desires. The duties of a cost accountant can be lightened considerably by co-operation from foremen. Conversely, the cost accountant is in almost a unique position to be of assistance to the foremen and certainly has it within his power to assist them to carry out their work more efficiently and economically.

If it can be accepted that one of the duties of the cost accountant is to provide management with data which will help it to manage more efficiently, it may well be argued that it is likewise the duty of the cost accountant to ensure a flow of information to foremen, so that they, too, may be able to carry out their work more efficiently. This follows automatically if it is accepted that the foreman is part of management. This word "management" has two meanings, viz.:—

1. A group of people actually running the organization as distinguished from the rank and file of employees.
2. A way of getting things done— the art and science of preparing, organizing and directing human effort applied to control the forces and utilize the materials of nature for the benefit of man.

Thus, if a man, by becoming a foreman, enters the ranks of management, his efforts should from then onwards be directed not towards doing things himself, but towards getting others to do them.

Requirements of Foremen.

It is not intended to do more than briefly touch upon the requirements of foremen. Some reference, however, must be made to the subject because some of the factors at least are of great interest to the cost accountant. In the first place, the foreman should have a thorough knowledge of all the work which goes through his department, and he should acquire a "management" way of looking at it. He should be able to tell the workmen under his control, not only how to do their work in the correct way, but he should be able to instruct them in such a way that they will want to do the job in this way. He should thus be a leader.

He must therefore be very familiar with all mechanical and technical phases of the work which comes under his control. He may not necessarily be an expert in every job. Very often the best mechanic does not make the best foreman. Nevertheless, any man who feels that he can become a first class foreman with only a superficial knowledge runs the risk of overlooking many factors which ultimately result in inefficiency.

A good foreman should be able to get the best out of his men and his machines. He should be thoroughly acquainted with the importance of getting quantity output without sacrificing quality. Indeed quality and waste control are amongst his most important jobs. He should be constantly looking for new ways and methods of carrying out the work—methods which will result in greater efficiency and/or increased economy. Furthermore, he must make a constant examination of production schedules to see that by processing the work through his department on time, he contributes the maximum amount to the co-ordination of work through other departments and the business as a whole.

The most important factor affecting the cost accountant, however, is that the foreman should have a knowledge of the fundamental principles of cost control. It is not necessary for him to be well versed in the principles of cost accounting, but it is essential that he should be able to examine intelligently the cost reports which are from time to time forwarded to him. He must realise the significance of the figures portrayed and should judge from them his course of action in relation to the remedies to be undertaken.

It is the function of the cost accountant to help in the training of foremen, and, of course, in connection with costs, the cost accountant is the logical teacher. It is usually wise to commence by describing to the foreman simply how costs behave, and to proceed from this to an analysis of the costs of the particular department. In connection with this teaching, the following factors should be borne in mind:—

1. The foreman should regard the department as his own business insofar as costs are concerned. This principle may be dangerous in connection with, for example, production, but in the case of costing, the foreman then obtains the correct viewpoint in connection with expenditures incurred. When he is able to exercise jurisdiction over the incurring of certain expenditures he will examine these thoroughly before committing his department to the amount.
2. It is well to teach him that he will be held responsible for costs under his control and for no others This will necessitate careful explanation in connection with each cost wherein his responsibility will rest. He should be informed how best he can control these costs and he should be given the figures which will be of assistance to him. These may include budget figures, figures of previous periods, suggested ratios.
3. The foreman should be informed of the cost aspects of quality control. This will involve, firstly, showing him how costs of products can increase through extra gradings; secondly, the seriousness of waste and spoilage: and, thirdly, the budgeted standards which he must aim to reach.

Important Report Factors.

It should be remembered that whilst the cost accountant can help the foreman, as stated at the outset, foremen can assist the cost accountant through the clarity of their records, the detail required, and the adherence to instructions given. The cost accountant should prepare reports to aid the foremen, realising that it is the duty of the foreman to prepare reports which are essential for the preparation of costing data. In connection with these reports, prepared by the cost accountant for foremen, the following should be regarded as fundamental principles:—

1. They should be prepared promptly. It is of no use giving the foreman data which is almost out of date. Psychologically it is wrong and from a practical standpoint value is greatly decreased. The less time to elapse between the actual happenings and the reports on them, the more valuable the report.

2. The report should be suited to his needs. They should deal directly and only with those factors which affect the foreman and which refer to matters under his control.

3. They should be simple so that they can be easily understood. Technical language should be avoided, if possible, and the lessons to be learned from the reports should be clearly defined.
4. They should make a point of showing what has happened as against what should have happened. It is of little use showing only what has happened. This may be accepted by the foreman as being satisfactory. If, however, figures showing what should have been attained are included, the foreman has a ready method of comparison.
5. Wherever possible, the principle of exceptions should be adopted. Let the reports be prepared in such a way that the foreman clearly recognises what has gone wrong, and can immediately concentrate his attention upon such. This is, of course, in line with management information generally.

Reports for Foremen.

The following would be typical of information which should be supplied:—

1. *Budget and Actual Costs of Operating the Department.*

These should divide the departmental expenses into two kinds, firstly those under the direct control of the foreman, and secondly those that are not. Alternatively only the first class of expense may be shown. (See Figure No. 108.) The actual figures should be shown alongside the budgeted amounts.

FIGURE No. 108.

DEPARTMENTAL COST STATEMENT

For Week Ended.................. ....

Department A	Budget	Actual
Direct Costs—		
Supervision	10 0 0	10 0 0
Wages	46 5 0	48 18 0
Repairs	6 3 4	6 2 0
Supplies...	4 15 0	5 1 0
Depreciation	8 2 0	8 2 0
Power	3 16 0	3 18 0
	£79 1 4	£82 1 0

Budgeted Units 80
Budgeted Cost 19/9¼ per unit
Actual Units 81
Actual Cost 20/3 per unit

Attention should be drawn to those amounts in excess of budget. Very often the foreman can best be assisted by the preparation of a Multiple or Flexible Budget which shows the amounts allowable for the various types of expense under his control at varying rates of activity within his department. (See Figure No. 109.) Not only will a statement of this kind enable him to see the extent to which he can allow his expenses to grow in the case of increased activity, but also it will provide him with a ready

FIGURE No. 109.

DEPARTMENTAL MULTIPLE BUDGET.

Department " D ".

100% = £1,500 Output.

		ACTIVITY.						
	Symbol No.	50%	60%	70%	80%	90%	100%	110%
Foreman	A14	£ 75	£ 75	£ 75	£ 75	£ 75	£ 75	£ 75
Assistant Foreman	A15				30	30	30	30
General Wages	A16	280	280	300	315	330	340	350
Inspectors	A17	40	40	40	40	40	40	75
Clerks	A18	50	50	50	50	50	50	50
Repairs	A19	60	60	80	80	100	100	120
Material Handling	A20	120	135	150	165	180	200	215
Supplies	A21	55	65	75	90	105	120	135
		£680	£705	£770	£845	£910	£955	£1050

guide as to when to make changes. In Figure No. 109 it will be seen that he must not appoint an Assistant-Foreman to his department until activity reaches 80%, that is £1,200. Very often a statement of departmental costs can be made more valuable where such costs can definitely be tied to output. In Figure No. 108, for example, the budgeted cost allowed was £79/1/4, and the budgeted units 80, giving a budgeted cost of 19/9½ per unit. The actual expenditure exceeded the budget by almost £3, but this was partly offset by the production of 81 units, instead of the budgeted 80. This meant that the actual unit cost was 20/3, which, of course, is too high as against the budget.

2. *Statement of Departmental Efficiency.*

In the case of some organizations, it is possible to prepare weekly efficiency statements. These set a standard output or adopt some other base method of marking efficiency, and with these, actual results are compared. Sometimes these reports treat the department as a whole, whilst others give the relevant particulars in relation to each operator. Reports of this type can be very valuable where the kind of organization lends itself to their preparation.

3. *Labour Costs and Turnover.*

Reports of this kind can very often be used to show the overall labour effectiveness within a department. To this extent they can be linked with reports mentioned under 2, above. Figure No. 110 shows, firstly, certain statistics in relation to labour turnover, and a labour turnover rate is developed. The total cost of wages within the department is shown together with the average wage earned and the labour hours worked. The actual rate per hour is then available for comparison with the budgeted rate. Further comparison may also be made with other figures shown on the statement and representing the relevant particulars of the previous week and the same week of the previous year. (See Figure No. 111.)

FIGURE No. 110.

STATEMENT OF LABOUR COSTS AND TURNOVER.

Department A	This Week	Previous Week	This Week Last Year
Men Employed at Beginning of Week	64	66	70
Added during the Week	3	2	6
	67	68	76
Less Discharged during the Week ...	2	4	2
Men Employed at End of Week ...	65	64	74
Labour Turnover ($\frac{5}{2} \div \frac{129}{2}$)	3.9%	4.6%	5.5%
Total Cost of Wages	£403	£408	£481
Average Wage Earned	£6 5 0	£6 15 0	£6 10 0
Labour Hours Worked	2,600	2,800	2,960
Budgeted Rate per Hour	3/1	3/1	3/2
Actual Rate per Hour	3/1.2	2/11	3/3

4. *Idle Machine Times.*

Idle machines cost money, and a foreman should be vitally concerned with these. They are not always his fault, however. They may be due to bad planning over which he has little or no control. Alternatively, lack of orders may be the reason. Nevertheless, it is important that the foreman should receive a consolidated statement of idle machine times. It is true that it is quite probable that he will know of idle machines before almost any other person in the organization. This will largely depend upon the type of planning involved. If there is centralised planning, the foreman may not be responsible, but if the planning is left to the foreman he may quite well be responsible. A typical statement of idle machines is shown in Figure No. 112. The cost accountant can best help by converting idle machine times into amounts. In this figure machine No. 101 Bevel Gear Shaper shows 132 hours as representing normal activity. Actually, the machine worked approximately 30 hours, leaving 102 hours idle time. If it can be shown that the normal machine hour rate is 3/- per hour, it follows that during the period idle time has cost £15/6/-, as far as this machine is concerned. Care must be exercised in preparing a report of this kind, but there can be little doubt that much greater emphasis can be laid upon these factors when the hourly figures are converted into money.

5. *Maintenance Costs.*

This is very often one of the most important cost factors. It is not unusual to find that where foremen are not cost minded, large expenditure can be incurred in repairs and maintenance, and some of this may well be wasted. Undoubtedly, it is a wise procedure to prepare a repairs and maintenance budget. This can be done in co-operation and collaboration with the foremen. It has the advantage that it forces a comprehensive survey of the various factors affected by maintenance, and enables a systematic plan to be developed. This not only avoids waste through duplication, but also ensures that every machine will be attended to as and when it is most desirable. Furthermore, costs in relation to maintenance can be worked out, and the budget thus prepared is of great value to the foreman firstly

FIGURE No. 111.

GAIN OR LOSS ON DIRECT LABOUR.

Department..................................

Product No.	Style No.	Budget			Actual			Remarks
		Production	Labour Units	Labour Man-hours	Production	Labour Units	Labour Man-hours	

in arranging his time-table, and secondly, as a guide to cost control. It is true that conditions frequently arise which necessitate a departure from the budget plan. Thus, an unexpected break may occur in part of a machine, and as production schedules are likely to be seriously affected, it becomes essential that immediate repairs be effected. Usually, in budgets dealing with this expense, provision is made for contingencies of this kind. At the end of each week or monthly period, a schedule of actual maintenance costs can be prepared for ready comparison with the budget allowances. This procedure, if carried out conscientiously, will speedily bring about an effective method of control over costs which all too frequently go unchecked. See Figures Nos. 113 and 114.

FIGURE No. 112.

STATEMENT OF IDLE MACHINE TIME.

Department A *Month*..................

Gear Cutting

Machine No.	Type	Calendar Hours	Normal Activity	Actual Hours	Percentage to Normal Activity	Remarks
101	Bevel G/Shaper	176	132	29.40	22.47	Undergoing Repairs
102	Bevel G/Shaper	176	132	103.30	78.41	
103	Fellows G/Shaper	176	132	116.53	88.55	
104	Lorenz G/Shaper	176	132	193.40	146.72	
105	Nework Auto	176	132	172.35	130.74	
106	Nework Auto	176	132	47.17	35.82	

FIGURE No. 113

MAINTENANCE SCHEDULE.

Maintenance of	Budget Allowance	Actual Cost This Month	Actual Cost Last Month	Actual Cost This Week Last Year
Power House				
Generators				
Motors				
Elect. Light Equip.				
Power Lines				
Pumps				
Refrigeration Equipt.				

6. *Spoilage Reports.*

Particularly in some industries, these are of the greatest value. Spoilage represents a direct attack upon the profits of the organization, but in addition can cause indirect losses through upsets to production schedules. Where spoilage occurs, it is often necessary to set in motion a chaser production order to manufacture the spoiled part, so that, for example, assembly operations will not be delayed. The surest way to stop spoilage

FIGURE No. 114.

SCHEDULE OF MAINTENANCE COSTS.

Budget Allowance for Month—£250.

Date	Requisition No.	Machine No.	Description of Work	Estimated or Budgeted Cost	Actual Cost			
					Materials	Labour	Expense	Total
				£235	£95	£90	£80	£265

is to ensure a realisation that a spoilage report is prepared each week and the mistakes of that week are entered in black ink on white paper. Not only is this valuable to the foreman, but also can help him with his operators, particularly where the spoilage of the department is set down in terms of various workmen. See Figure No. 115. Special attention should be paid to this item whenever the actual results exceed the budget allowance.

7. *Quality Control Reports.*

Actually the spoilage report, mentioned in 6 above, is part of Quality control. Other factors, such as waste and scrap, can also be included. In many industries, however, it will be found that there is a final inspection test of products before acceptance. The difference between acceptance and rejection might be very fine, and reports which give information to the foreman may be of great assistance to him in reducing reject percentages. In other industries the product is automatically graded into, say, firsts, seconds, and other gradings. (See Figure No. 116.) Very often it will be found that the difference between the market prices obtainable for firsts and seconds, and to a greater degree between first and other gradings is considerable. The organisation may have to look for its profit entirely from its firsts production. Seconds may barely pay costs of production, and other gradings may not do so. An increase in seconds and other gradings as against firsts, may therefore have a very serious effect upon the profit of the organization. Quality reports should, wherever possible, be prepared in terms of budget and actual, and an explanation should be demanded where actual percentages exceed the budget allowance. It is true that the foreman of the department may not be responsible for excessive gradings, but reports of this kind enable reasons to be traced and remedies applied.

8. *Material Consumption.*

Certain industries lend themselves to statements such as gain or loss on material consumption. This is particularly so in textiles which are operating under standard costs. Here the standard fabric allowance in relation to each style of product is known. The production to be undertaken is also known, and therefore it is a simple matter to calculate the total fabric required. Where this is exceeded, it should be brought to the notice of the foreman. Here again, it may not be his fault, but an analysis of the reasons for the excess requirements will show those for which he can be held responsible, and those which must be traced elsewhere. Very often it can be arranged that only the standard amount of fabric is delivered to the operator, and any excess requirement must be authorised by the foreman. This enables him to check the matter at the outset, and to ascertain the cause. Wherever an excess requisition is prepared the reason for its preparation should be shown. A similar procedure is often adopted in other organizations where standard bills of material are prepared. As was indicated in earlier chapters, excess requisitions are frequently of a different colour and this procedure will facilitate the preparation of a report of this kind. See Figure No. 117.

The foregoing is not a complete list of reports which should be supplied to foremen. The number and type should depend upon the circumstances operating within each organization, but usually the fewer reports forwarded, consistent with adequate cost control through the foremen, the better. It should be remembered that the cost accountant is not the only officer interested in forwarding reports to foremen. There are others such

FIGURE No. 115.

SPOILAGE REPORT

Department.................................. *Budget Allowance*.................

Operator No.	Operator Name	Total Production	Passed Inspection	Rejected	Reject Percentage	Cost of Rejects	Reason for Rejection

FIGURE No. 116.

QUALITY CONTROL REPORT.

Department.................................... *Month Ended*.....................

Product No.	Style No.	Total Production		Firsts		Seconds		Other Gradings		Remarks
		Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	

as Absenteeism, Accidents, Attendance Factors, etc., in all of which the foreman is interested.

Frequency of Reports.

A further factor which warrants attention is the decision as to the period to be covered by reports. Some may be prepared daily, others weekly, and some monthly. The fundamental principle in this regard is, as indicated previously, that reports should be prepared as promptly as possible and should not become stale news. Furthermore, if kept within reasonable proportions, reports may frequently enable weaknesses to be rectified more quickly. Consistent with the attainment of his objects, the cost accountant should co-operate with the foreman in fixing the periods to be covered.

Co-operation with Foremen.

This co-operation, however, is not restricted to this matter. It should be in evidence in all dealings with the foreman by the cost accountant. He is much more likely to obtain the results he desires, if he, as cost accountant, approaches the foreman in a helpful spirit, desiring to show how efficiency can be increased, how economies can be made, and how the foreman's job can possibly be made easier. With a proper approach all these factors are consistent.

In some organizations it may be necessary for the cost accountant to approach the foreman only through the works manager. In virtually all organizations the cost accountant should keep the works manager acquainted with the nature of the discussions with the foremen, and usually copies of reports to foremen are sent to the works manager. In cases where co-operation is not readily forthcoming from foremen, the advice and assistance of a co-operative works manager may be invaluable to the cost accountant.

The cost accountant should remember at all times that in helping foremen he is helping management. It is therefore worth while to devote careful attention to his relationships with foremen, and to see that not only are the relevant figures forwarded to foremen, but any suggestions that he can make through his wider knowledge of the business as a whole, should be carefully (and sometimes tactfully) made. It is probable that cost accountants in the past have not done all that they could in this connection. There has been an increased management outlook on the part of foremen during later years, and time therefore seems ripe for a closer collaboration between costing and foremanship, and the inauguration or extension of costing reports to foremen so that they can carry out the duties of foremanship in a more scientific manner.

FIGURE No. 117.

MATERIALS CONSUMPTION.

Department.................................

Product No.	Style No.	Fabric No.	Standard Quantity	Actual Quantity	Price	Standard Cost	Actual Cost	Remarks

CHAPTER 34.

UNIFORM COST ACCOUNTING.

Development of Uniform Costing.

It is a common saying of business men that the type of competition that they most fear is that which springs from a lack of knowledge of costs. Such competition is of an unenlightened and unreasonable nature and usually there is not the ordinary corrective of a comparison of actual cost figures and the selling price. Ignorance on these points usually results in a continuance of the competition and also in quotation of prices which are often greatly affected by wishful thinking.

Factors such as the foregoing have made business men realise that there is much to be gained in spreading a knowledge of costs amongst their competitors in business. For a long time the best method of spreading knowledge, in relation to costs, among others in the trade was a very difficult problem, but a solution has been found in the adoption of uniform cost accounting.

This was defined by the Department of Manufacture of the Chamber of Commerce of the U.S.A. as under:—

> " Uniform Cost Accounting comprises a set of principles and in some cases of accounting methods which, when incorporated in the accounting systems of the individual members in an industry, will result in the obtaining of cost figures by the individual members of the industry which will be on a comparable basis. Uniform Cost Accounting does not mean the preparation of average or Standard Cost figures for the industry, nor the inclusion in costs of pre-determined or fixed elements of cost."

Uniform Cost systems have become a feature of American accounting practice, and there are now over 150 trade associations which have arranged for some form of Uniform Cost Accounting or Cost Reporting amongst their activities.

The first steps taken in this direction came from a group of Steel Foundries in 1902, the impetus coming from the Steel Founders' Society of America. Five years later the Printers of New York, Philadelphia, and Boston organised a joint committee to study various costing questions. These negotiations culminated in an attempt to prepare a Uniform Cost System in 1910, and prior to its adoption in 1911 an extensive educational campaign was undertaken.

The principle was adopted by other trade associations, but the movement received its first real impetus during the First World War. The artificial conditions operating at that time, together with the numerous controls instituted, necessitated recognition of the importance of costing and the advantages to be gained from a wide-spread knowledge of its principles. Furthermore the report of the U.S.A. Federal Trade Commission in 1916 showed an alarming lack of costing knowledge and an attempt was made to rectify this. Since that time the growth of the movement has proceeded steadily, with satisfactory progress. Considerable impetus was given in 1933 with the National Industrial Recovery Act, which made uniformity of cost methods almost compulsory by virtue of the codes provided. If the N.I.R.A. had not been held unconstitutional the adoption of Uniform Cost Methods would have been even more widespread. Nevertheless some failures have been recorded. In some cases the Trade Association has steadily withstood efforts to promote the preparation and adoption of Uniform Costing, and in other cases the matter has been dropped even after a period of trial.

In Australia there has been no general recognition of the value attaching to uniform methods, though there are a few instances where it has been adopted. A study of the subject is not only warranted, but very desirable, in view of the advantages to be gained, and also the fact that here in Australia there is a ripe field for an extension of the principles. In a very limited way, war conditions and the adoption of "Standard Conditions" in war contracts, have paved the way for a fuller consideration of the whole subject. It will be the conditions following the Second World War, however, which will be the most likely factor in showing industry not only the advantages to be gained from the adoption of uniform costing methods, but also the necessity for the education of members to facilitate such adoption.

Objects of Uniform Cost Accounting.

There are two main objects which stand out amongst a number of lesser objectives. These are:—

1. To provide basic cost information for the development of adequate price policies within an industry, thus improving and providing more enlightened competitive conditions.
2. To promote operating efficiency by a more thorough knowledge of costs and the comparison of results with the average results for the industry.

The lesser objectives are:—

1. To obtain for each member of the industry all those benefits and that more complete knowledge usually associated with the provision of accurate cost data.
2. To raise the tone of business within the industry by the development of managerial information, based upon cost statistics.
3. To promote a greater degree of stabilisation within industry, by the provision of earliest information relating to business weaknesses.
4. To facilitate the production of figures for the industry as a whole, so that they can be available for the spreading of suitable knowledge amongst the general public and, where necessary, to discourage further expansion of unneeded plant facilities.
5. To assist businesses in the preparation of Income Tax data, or of information for price fixing.
6. To promote collaboration within the industry in relation to the elimination of unprofitable items and inefficient methods of production.
7. To record, for the benefit of members, the one best method of cost accounting to fit the particular industry.
8. To provide a system which, known throughout the industry, assists in the problem of training staff, or effecting replacements.
9. To inspire confidence amongst the public that selling prices are based on accurate and fairly assessed information.

Objections to Uniform Cost Accounting.

Opponents of these methods usually base their reasons upon the following:—

1. The establishment and maintenance of uniform methods are too expensive. This cannot really be sustained, as a rule, because whilst the initial expenditure is heavy, the adoption of uniform methods by business units within an industry can be undertaken at much less expense than would be incurred by the installation of a costing system in each unit. The very nature of the methods also means that considerable savings can be made by all kinds of standardisation.
2. The various business units do not lend themselves to a standardised method. There may be some element of justice in this connection. Most uniform accounting systems, however, lay down general principles and do not expect every concern to follow individual details slavishly. Some associations have recognised that the degree of detail desirable (and even necessary), in a large business would not appeal to a smaller unit. Two methods have therefore been laid down, one for the large and one for the small business. Some difficulties have also arisen, because accountancy bodies have not sufficiently standardised and defined accounting terminology, and this is a work which must shortly be undertaken in real earnest by the accountancy profession.
3. It is difficult to arrange for all concerns to disclose their figures. This is a condition which is often met. To a certain extent at least the answer lies in educating the various members of the association into the benefits to be obtained from the uniform methods, and an acceptance of the general fact that it is designed to help each individual unit and the industry at large. This objection is frequently overcome by a clear recognition of the fact that there is no disclosure whatsoever of the figures of any individual concern, but the general or average results of the industry as a whole are at the disposal of each member.
4. There are sometimes legal factors involved. This would not operate in Australia. In America, however, it is a very real matter and for a long time there was considerable doubt as to the validity of preparing uniform cost classification and manuals.

Scope of Uniform Cost Schemes.

All trade associations have not developed along the same lines. Some have been content with a very general approach,, whilst others have arranged for a most complete cost picture to be available to all members. The question of scope can be best understood by an examination of the following steps towards complete cost collaboration within an industry:—

1. A general discussion on costs on the occasion of Annual Conventions and occasional references to costing in official publication mediums.
2. A wider survey of general cost accounting principles, with advice for the guidance of interested members.
3. The development of suggested cost accounting methods, and informal procedure or formulae, very often with no relationship to financial accounting records.

4. The collection and distribution of trade statistics of a costing nature without any attempt to standardise these through the application of uniform cost methods.
5. The preparation of a uniform cost accounting system with provision for its inclusion within the general accounts, and frequently the provision of a cost manual for the guidance of those adopting the system.
6. The collection and distribution of cost statistics, prepared as the result of the adoption of uniform methods.
7. In addition to the uniform costing method, the provision of consulting or advisory cost accounting service.
8. The distribution within industry of managerial information relating to such factors as estimating and pricing within uniform cost methods.
9. The provision of information relating to subjects allied to cost accounting, together with advice relating to such matters as differential costs and normal capacity.
10. Education relating to methods of budgetary control and the method of its adoption within the industry.

Method of Development.

The degree of success finally attendant upon a uniform cost plan is determined by two factors:—

1. The degree of enthusiasm which can be raised in connection with the initial installation.
2. The care with which the uniform methods are prepared and developed.

The work of promoting sufficient interest to provide the initial step is frequently difficult and must be continued over a fairly lengthy period. There is, at first, a degree of scepticism and also a reluctance to hand over to an association figures relating to a particular business. Usually the winning of popular approval takes a long time. Furthermore, even when consent is obtained to the proposal, it is difficult to maintain interest during the period when the installatory work is being carried out. There is a period in most installations when time seems to have elapsed with no corresponding degree of accomplishment. During that period there is a temptation to withdraw support from the scheme and to abandon the venture.

The necessity for careful preparation of the plan requires no amplification The ultimate success or failure is determined by the thoroughness with which all relevant factors are examined and the results fitted into the general scheme. The preparation of a uniform cost system usually proceeds through the following channels:—

1. The association finally decides upon the desirability of a uniform cost plan. It directs that the necessary action to give effect to its desire shall be carried out by a Cost Committee.
2. The Cost Committee must undertake the development and promotion of the procedure. Such Committee would have a knowledge of the special problems involved within the industry, and would be of very great value to those who actually prepare the plan. The desirable

size of the Cost Committee depends upon a number of factors and must be considered in the light of the conditions within the industry. Even after the installation of the plan, the Cost Committee frequently continues to function, offering a general direction, as opposed to a technical direction which would be exercised by the Director of Cost Accounting activities.

3. The appointment of specialists to carry out the installatory work. Such specialists should obviously comprise those who are very thororoughly acquainted with cost accounting problems and who by their experience would bring expert knowledge to the solution of the difficult matters involved. It may be necessary to co-opt the services of specially qualified technicians, or of consulting engineers. The one thing which must be borne in mind is that only the best system can be regarded as satisfactory.

Usually the cost system would involve:—

1. *A suggested classification of accounts.*

This in itself would involve a complete examination and knowledge of the industry, so that the one best chart could be prepared. Frequently difficulties arise as the result of decisions being necessary regarding the degree of detail desirable. This may differ somewhat in the case of large and small organisations.

2. *The Cost Manual.*

In conjunction with the Classification of Accounts and in explanation of it, the Cost (or Accounts) Manual is one of the most important factors in uniform costing. It examines each account in the classification, explains its use, and shows how it should be treated. Examples of various entries, together with a detailed description of the procedure is shown. The cost Manual also often includes studies in Overhead Distribution and suggested managerial reports for periodical preparation. The exact form differs within each industry, some being a somewhat terse statement of accounting and costing factors, whilst others represent an elaborate presentation of complete accounting, costing and managerial factors.

The "Manual of Accounting Practice," published by the National Electrical Contractors' Association of U.S.A. begins with a statement of the following principles:—

"1. All forms should be standardised.
2. All sales, whether contract, day work, or retail, should be costed.
3. A merchandise account should be created through debit entries for purchases and credit entries at cost for materials sold in any way.
4. A general ledger, containing all controlling accounts, should be made a part of this system.
5. All liabilities should be vouchered each month, irrespective of receipt of goods or corrections of invoice. Provision should be made for charging vendors for any errors or discrepancies in bills.
6. Cash books should combine bank records, both receipts and payments, so that debit entries equalise bank deposits for the month and credit entries equalise charges to bank balance. The cash book should not be used for distribution."

The Cost Manual of the "Graphic Arts Industries" is based on Standard Costs, and provides:—

"1. A statement of principles including the tie-in with the general books, the method of developing standard or normal machine rates, etc.

2. A list of production centres, with explanations of each.
3. A basis for accumulation of Factory data on payrolls, materials, production reports, orders, etc.
4. An explanation of cost ledger accounts, including the allocation of specific expenses to the various cost accounts.
5. The development of monthly cost rates.
6. The development of budgeted or standard rates.
7. The determination of individual job costs.
8. The bookkeeping procedure.
9. Monthly statements."

3. *The Detailed Cost System.*

Sometimes this is not included in the Manual, but with all necessary Forms, Journal Entries, and a detailed account of procedure, is the subject of a separate submission. Actually this can be regarded as separated, but nevertheless a portion of the Cost Manual. The degree of detail shown in the cost system varies within particular industries. Some even go as far as to standardise on the accounting books necessary, and illustrate standard treatments in relation to such factors as Repairs and Maintenance.

When the installation has been completed, the next step is to promote its use by the individual members of the trade association. It is sometimes found that whilst individual members are prepared to sanction and sponsor the preparation of a uniform cost plan, they are not prepared to discard their own costing and accounting methods and to instal the new procedure. Where installation of such new procedure is carried out within an individual unit, it can be effected by:—

1. The organisation appointing its own accounting personnel to carry out the work.
2. The organisation appointing outside consultants.
3. The use of specialists on the staff of the trade association for the use of the consultants who actually prepared the plan.

Sometimes the outside consultants who are responsible for the preparation of the uniform method are also engaged to carry out the individual installations within the industry. Even so, however, there may be no obligation upon a member as to the means of installation to be adopted.

Where interest in the uniform method is found to have flagged, it can sometimes be revived by a method adopted by the American Malleable Castings Association of U.S.A., which conducted a special test amongst its members. It submitted a hypothetical order, with identical specifications, asking for itemised bids. The results showed extremely wide variations as the estimates ranged from between 4.9 cents to 11.6 cents per lb.

Statistical Activities.

In many cases information is not limited to costing features, but on the contrary involves many business statistics which are found to be of the greatest value to the business units within the industry. Such statistics may relate to factors like Production, Sales, Stocks, Prices, Operating Hours, Wage Rates, Absenteeism, Market Trends, etc. In this connection, the executive of one organisation states:—"We furnish our members

periodically with a considerable number of accounting and statistical reports —These include the following:—

(a) A semi-monthly report of stocks of product on hand.

(b) Weekly reports of the production volume of the industry as a whole and of the principal producing units.

(c) Weekly reports of shipments to and stocks on hand at important consuming markets.

(d) Weekly reports of average prices realised of certain important products, and comparisons between product price and raw materials prices, designed to indicate the available operating margin under current conditions.

(e) Monthly reports of the statistical position and outlook with a general summary of the results of operations for the year to date."

Usually the information necessary for the preparation of such statistics is obtained from members by the completion of a questionnaire. In certain cases, monthly or periodical statistics are required, a printed form covering these being filled in. Usually instruction is necessary to show just what is required from members, so that the resulting statistics would accurately set forth the position. Sometimes a report form with two columns is sent out, the first column being used for the insertion of the statistics relating to the individual company, and the second column, filled in by the Association, with the average ratios for the industry. The report is returned by the Association to the individual organisation.

Obviously, the information presented, whilst developed in accordance with the uniform method, varies in different industries. The three main statistical bases used are:—

1. Unit Costs.
2. Ratios.
3. Index numbers.

Unit costs involve the presentation of costs per product unit, as for example, per ton, per bale, per gallon. This is a very acceptable method, where suitable for the industry. Ratios are often used to express each item of cost as a percentage or fraction of total cost or sales value. Index numbers are used in limited cases where their application is possible.

Such statistics may be developed, not only in relation to the overall factors within the industry, but also in relation to geographical areas, businesses within a certain size range, or those adopting similar methods of production or selling. The frequency with which statistics are prepared conforms to no inviolate rule. Probably the most frequent period is half-yearly, though many associations submit figures only on annual basis, whilst at the other end of the scale some make even a monthly comparison. Furthermore, special conditions within an industry may promote or necessitate statistics relating to a particular phase. Where, for example, an industry wishes to approach a Government Department, either in relation to the quotation of prices, the display of costs, or the advising of capacity available, special statistics may need to be prepared by members for inclusion in the overall figures.

Results of Uniform Cost Activities.

Some of the uniform cost systems have been sufficiently long in operation in America to enable a judgment to be made as to their value. In general it can be said that there is a growing recognition of the value of such systems, and the experience of those who have enjoyed their adoption over a period of years has amply sustained this contention.

One of the main advantages is to be found in the educational outlook which has resulted. Members have become cost conscious, and a much broader interest in costing problems generally has been evidenced. Literature relating to costs within the industry has proved popular, and these factors have in general been responsible for a more scientific approach to competition and price factors.

An executive of the American Photo Engravers' Association described results in the following way:—

> "The practical results of our work has been a great increase in understanding in our industry of the importance of costs, and of the value of correct cost knowledge in operating a plant in an efficient manner and in securing a proper return for work done . . . . Throughout our entire industry there is a great deal of respect for the figures gathered by our association, and a feeling that the information we give is sound, correct and of practical value to the industry. Many concerns that do not operate cost systems advise us that they are guided in their work by our findings and that they attempt to follow as closely as possible after the thoughts that are derived from our cost investigations."

Similarly, a foreword of the Manual of Accounting Practice of the National Electrical Contractors' Association states:—

> "A comprehensive cost accounting system is the best check in the world upon productive efficiency. Every item of expense is set out in such a way as to permit comparisons from month to month and from year to year in the individual business, and where the system is uniform it has the added advantage of providing the means through which users of the system can compare with each other."

Many claims have been made in support of benefits received by adoption of uniform cost methods. Obviously the citation of such benefits does not preclude the possibility of other factors entering into the question. It is interesting to note, however, that the international association of Ice Cream Manufacturers of U.S.A. has stated that during the period between 1925 and 1929 manufacturers using uniform accounting methods reported a total cost reduction of 11.05%, whilst those not using the system showed a cost increase of 1.06%. The quotation of such statistics, whilst indicative, is not conclusive to the extent named, but it can be said that in general much benefit has been felt by most industries by the adoption of uniform methods.

These benefits have been summed up by Mr. Herbert Orem in an address to the National Stationers' Association (U.S.A.) as:—

"1. Better executive control, through the development of operating ratios and cost statistics.
2. Provision of a basis of comparison through averages or estimates derived from uniform cost methods.
3. Increased profits by reducing costs as a result of comparison with standards.
4. Stabilisation of sales price through knowledge of the no-profit point.
5 Development of better business men through study and analysis of accounting statements.
6. Increased prestige for an industry.
7. Improved recognition on the part of bankers."

When it is proposed to proceed with an installation, care should be taken to see that the time required to carry out the work is not under-estimated. Obviously, the period will depend upon the amount of work involved and the difficulties of the installation. Where it is desired to carry out the work thoroughly and in such a manner as to ensure for members of the association the utmost benefits, the time which would elapse before the installation was completed would be rarely less than 12 months. Furthermore, after this period had elapsed, a further time would be necessary to gauge the results of the installation and to check any weaknesses and difficulties which became apparent.

The routine described in this chapter has been largely based upon experience in the U.S.A., but no apology is made for this fact. As stated at the outset, the field in Australia is full of possibilities, and these will no doubt be explored during the next decade. It is felt that there is a pattern available in the U.S.A. experience, without in any way suggesting that such a pattern should be slavishly followed. There is also an obligation upon professional and commercial accountants to assist industry in obtaining the requisite knowledge and the desirable information to provide an impetus to plans of this kind, for in such a way accountants generally can provide an additional service to industry.

The principle of uniform costs is likely to be extended to agricultural pursuits. Recent developments suggest that much assistance to agricultural industry can be given if more information in relation to costs throughout the industry becomes available.

Standardized Accounting.

Whilst dealing with the subject of uniform cost systems it seems advisable to draw attention to the experiment in standardised accounting, as practised in Germany. Information in this regard has come from a publication of the National Institute of Economic and Social Research "Standardised Accountancy in Germany" by H. W. Singer, from which extracts given hereunder are quoted.

The author at the outset draws attention to the distinction between the German method and uniform cost accounting as generally understood. He points out that the former is much wider in scope and is not only uniform, but compulsorily imposed from above, and therefore outside the control of the individual firm.

Standardised accounting came into being in 1934, in connection with the first Four-Year Plan. In this connection, Dr. Singer states:—

"With the change-over from widespread unemployment to scarcity of labour; with the new productivity drive; with the wholesale regrouping of firms and even of whole industries for the attainment of self-sufficiency; with the drive for rapid rearmament; and the creation of new organizations designed for complete control of an industry, rather than for occasional interference; with all these changes the role of accountancy inevitably came under consideration, as providing both methods of improving industrial efficiency and also statistics to serve as 'barometers' for the use of the public or semi-public organs of control.

The basic decree which marked the birth of the new standardised system was issued on 11th November, 1937, under the title Principles of Bookkeeping Regulations (Grundsatze fur Buchhaltungsrichtlinien). We quote first from the decree itself, which was signed by Goering in his capacity as Commissar for the Four-Year Plan. 'The new aims of the German economy call for increased output and efficiency from business undertakings. The fulfilment of this great task requires a thorough knowledge and a close control of all business transactions. Thus a well-developed accounting system is a primary factor in the re-organization of industry. The public interest and in particular the aims of the Four-Year Plan demand that the accounting system of all firms should be arranged on uniform principles. Systematic mutual exchange of experience, especially in the form of comparative analysis of companies will help towards this end.' The importance attached to accounting questions is clear from this quotation." (Page 15).

As far back as 1927 the Reich Economic Development Trust had laid down systems of uniform bookkeeping for a large number of industries and by the end of 1938, a compulsory model chart had been approved and introduced by nine groups out of 33. By the middle of 1939, a further 15 groups had fallen into line.

The model chart of accounts is so framed as to be generally applicable to a central industrial group. It was supplemented by a plan of accounts which actually consisted of subdivisions of the model chart required by certain branches of industry.

The model chart is divided into ten main headings, viz.:—

0. Items of Capital Expenditure.
1. Liquid assets and liabilities.
2. Adjustments or reconciliation accounts and reserves.
3. Stocks of materials.
4. Dissection of costs.
5. Allocation of cost to departments and production centres.
6. Allocation of costs to products.
7. Work in progress, with semi-finished and finished parts.
8. Sales accounts.
9. Profit and Loss accounts.

The plan of accounts is based on similar principles and represents the subdivisions as, e.g., 011 might be A.B. Bank A/c., and 012 C.D. Bank A/c.

Dr. Singer shows a manufacturing cost sheet in which are displayed 43 production centres which are:

" General	5	Premises, Water supply, Engine house, Power station, Welfare institutions.
Manufacturing	12	A-M which represents individual workshops.
Auxiliary	7	Technical manager, General office, Wages office, Boiler house, Tool room, Repair shop, Inspection department.
Materials	4	Purchasing department, Transport, Receiving and Control, Storage.
Administration	7	Management, Financial book-keeping, Cost Accounting, Statistical office.
Selling and Distribution	8	Management cars, Stationery and Catalogues, Advertising, Samples, Distribution, Delivery vans, Travellers' cars, General.
	43	

Together with the 6 sub-totals, and the grand total, the basic sheets therefore require the analysis and separate return of costs under 49 different headings.

Vertically, 25 different types of costs are shown which are allocated over the 43 (or 49) production centres. The total number of entries is, of course, much less than the theoretical total of 1075 (or 1225) because not all types of costs arise in all production centres.

Finally, the allocation of the costs of overhead departments to the manufacturing departments is also shown." (Page 23.)

The publication sets out some of the ways in which the standardised systems are used and in this connection states :—

They show monthly figures, separately for each of the manufacturing production centres (workshops), of:—

(1) The ratio between wages and other expenses expressed as a percentage.
(2) The number of machine hours worked in each department.
(3) The cost per machine hour.
(4) The quantity of output.
(5) The average total cost per unit of production.
(6) The average direct wage cost per working hour (giving an indication of the type of labour employed).
(7) The degree of utilization of capacity, mainly based on (2).

"It is obvious," Dr. Singer says, "how valuable such detailed information submitted month by month must be for purposes of labour control, price control, and the control of the extent to which capacity is utilized. The German report to the Fifth International Accountants Congress, held in September, 1938, describes the Manufacturing Cost Sheet as used in Germany as an 'indispensable link between bookkeeping and cost accounting.' On the other hand an article in a German trade journal contains an example of excessive detail in a Manufacturing Cost Sheet. In the quoted case total overheads of 170,000 marks (about £14,000) were dissected into fifty categories of cost and allocated to over forty cost centres, which required 2000 different accounts. This excess of zeal is criticized as doing more harm than good." (Page 24.)

A summary of the whole position has been given in pages 50/51.

"The purposes served by the standardized system can be summarized as follows:—

(1) To facilitate the planning of state departments by supplying significant statistics based on uniform and known definitions. It is mainly for this reason that the model chart and plans are based on the decimal system throughout : ten main headings, numbered 0-9; each main heading again to be subdivided, where necessary, into ten, but not more than ten, sub-headings, again numbered 0-9. This is done to facilitate the mechanized tabulation of results for whole industries on Hollerith machines. It is one of the inevitable drawbacks of the decimal system that the number of possible classes and sub-classes is so rigidly limited and that there is no scope for the horizontal growth of the system. Any addition must be by way of further subdivision. The use of punched card machines has increased enormously since the introduction of the standardized system, both in government departments and business firms. The latter used 70% of all machines according to a recent statement, 'where they help to cope with the not inconsiderable requirements of the new standardized accounting system.'

(2) To assist government departments in giving out public contracts by the use of the model chart, to allocate contracts rationally to firms most suited to that particular type of production and to fix prices on the basis of uniformly ascertained costs of production.

(3) To the economic group the main use of the system consists in the way in which it enables the organization to determine the relative

efficiency of various firms, for example in the execution of concentration schemes, community working (pooling of resources and profits), the prohibition of new investments, etc. The groups also use the system for the assessment of individual undertakings for the payment of statutory levies or subsidies, for example, subsidies to high-cost producers to enable prices to be fixed on the average cost of production for the industry as a whole.

(4) The individual business is enabled by the uniform method to determine 'where it stands' in relation to other firms, and the uniform methods of allocating costs and earnings to its various departments assist managers in tracing sources of waste and weaknesses within the organization.

(5) Firms which had not previously developed adequate accounting systems, particularly private firms, are to be trained by the new system in keeping proper books. This, it is hoped, will stimulate more rational and efficient methods.

The importance attached to the standardized accounting system by the German authorities can be gauged by the fact that they have taken steps to enforce it in occupied countries as well, wherever it is required. By way of example, an order by the German Commissioner for Agriculture addressed to Dutch food growers states that 'directions can be issued as to the type of bookkeeping and management required'."

The final outcome of the experiment in standardized accounting will be watched with interest. Undoubtedly, there is much to be gained by a standardized approach, but the advantages are greatly outweighed by the compulsory direction of the accounting system. Nevertheless, it is probable that some features included in standardized accounting will be incorporated in uniform cost systems and as indicated at the outset of this chapter there is a tremendous scope in Australia for the voluntary preparation and adoption of uniform cost systems at least in relation to certain types and classifications of industry.

CHAPTER 35.

INSTALLING COST SYSTEMS.

The installation of a system of cost accounting necessitates a very thorough knowledge, not only of the principles of the subject, but also of such factors as organisational procedure, systematic planning, production control, personnel problems, mechanised accounting methods and many other matters not directly associated with the routine work of cost accounting. It necessitates a clear vision so that after the requisite preliminary survey, the desired end may be envisaged almost from the beginning. In addition, the correct psychological approach to the various problems likely to be encountered is essential. As with a system of budgetary control, there is very often a veiled or open antagonism which, whilst it may not show itself in open rebellion, may at least be in the form of passive resistance.

Again like budgetary control, the installation of a costing system to be successful must have the support of management. Indeed, strong support from the top will smooth many of the difficulties that will undoubtedly arise. It is true that sometimes cost accounting systems are commenced with a grudging assent by management—almost in spite of it. This makes the task immeasurably more difficult. The approval of the executives will go far towards obtaining the co-operation of departmental supervisors and foremen. This support will be found most valuable in that most difficult period when some time has been spent on the installation and there is very little in the way of concrete results to show. This period is sometimes even more difficult when one costing system is being changed over to another, because the stage is sometimes reached when it appears that most of the old has been broken down and little of the new instituted. To avoid this period as far as possible, careful planning is essential.

Initial Factors.

The exact procedure to be adopted in any installation depends upon what is required. An existing business, having no costs of any kind, may require a costing system; an existing business, with some inadequate records, and partial costs, may require a complete system, built either on these records or a new system dispensing with the old; an existing business, with good records and a partial costing system which is quite satisfactory, might want its costs extended to embrace all cost accounting functions; an existing business, with a job order or process method of costing, may desire this changed to a standard cost system; a new venture, just commencing production, may require a cost installation.

The description of cost installation procedure in the following pages is based upon an assumption of an existing organisation which has little in the way of cost records of any value. The procedure may be summarised by dividing it into five stages:—

1. Surveying,
2. Planning,
3. Installing,
4. Operating,
5. Perfecting.

The work carried out in each of these stages is described hereunder.

1. Surveying.

This aspect is sometimes divided into two parts: Where management is undecided whether to proceed, it is sometimes necessary to make an initial survey, so that various factors such as cost, time to instal, personnel necessary, and similar matters may be examined and estimates made for submission to management. When it is decided to proceed with the installation a much more thorough survey becomes necessary. This may take a considerable time, but usually such time is well spent, because the ultimate success of the installation may well depend upon the careful analysis of the facts disclosed. Whilst a survey need not necessarily be made in this order, it would probably need to take into account and give consideration to :—

1. *Financial Statements.*

These would give an overall picture of the organisation, and the classification of its accounts, its capital structure, sales, profits, manufacturing accounts together with all financial trends.

2. *General Organisation Plan.*

This is the best method of obtaining a clear view of the organisation, and would indicate the line of responsibility. Careful attention should be given to dual responsibilities or those cases where the responsibility is not clear cut.

3. *General Functional Plan.*

This is supplementary to the Organisation Plan, and should disclose the functions carried out at least by the executives. Names of all executives, together with those of supervisors and foremen should be indicated, particularly where the installation is being carried out by someone not associated with the business. This plan should disclose any confusion in relation to functions either through two or more sharing the responsibility or cases where particular work does not seem to be the function of any particular individual.

4. *General Ledger Accounts and Classification.*

An overall view of the accounting factors in the business should be possible from this inspection. The classification will disclose many things to a practised eye. The method of treatment of accounts as a whole or the accounting sub-division between departments, the method of apportionment, and the degree of accounting detail must all be grasped as essential knowledge.

5. *Building Plan and Plant Lay-out.*

This is highly important, and adequate details should be given of each floor in the building, together with productive space, space used by various services, the plant lay-out, location of store-rooms, etc. Ultimately these plans will be required for the allocation of floor space to departments and if need be to cost centres, but at the outset will facilitate a quicker grasp of various production factors.

6. *Flow Chart of Processes.*

Particularly where there is no detailed knowledge of the technical processes carried out within the plant, this chart should be the subject of considerable close study. There can be little doubt that the success of some cost installations definitely depends upon a thorough appreciation of productive factors which can only be gained through an intimate knowledge of the flow of processes. It is advisable to trace the flow of products from the first to the last operations by means of the chart, so that subsequently an inspection of the latter may conjure up a vision of the actual processes as they were inspected.

7. *Classification of Products.*

It is advisable to obtain a full classification of the products manufactured and the departments through which they go. The system of codification should also be noted, and a decision reached as to its adequacy.

8. *Production Factors.*

These are many and varied, and may necessitate spending some considerable time in the factory. Amongst the matters to be examined would be:—

(a) The number and kind of production departments, together with the contribution which each makes to the finished product and the degree to which each is dependent upon the preceding department.

(b) The number of service departments and the type of service rendered by each. The location of each should have been noted from the plans. Where only certain production departments are serviced this fact should be noted.

(c) One of the most important factors within production is the system of production planning in operation and its adequacy or otherwise. The success of a cost accounting installation can very often depend upon the production planning in operation, partly because cost accounting records are sometimes intertwined with production procedure. Where a plant is operating on production orders which follow the product and which have to be costed as production orders, clarity in production procedure is essential. Furthermore, the correct recording of work in process and transfers from one department to another may be essential for accuracy in cost accounting records, and this may not be achieved unless the routing of work is organised. As a result of a survey of this factor alone, it may be found that not only is a cost accounting system necessary, but that the work should be expanded to take into account production planning and control.

(d) Functional responsibilities within the plant should be investigated. Some indication of these may have been obtained from the Functional Plan, but additional attention would be necessary, particularly where it is ultimately desired to see that reports on operating results flow through to the various foremen.

(e) A systematic survey of plant facilities will be essential. Apart from the importance of this factor in production, many vital questions to the cost accountant will spring from the plant. Ultimately decisions may be necessary in relation to the advisability or otherwise of the use of machine hour rates, the computation of idle capacity, the use of cost centres, the preparation of plant ledgers, and the calculation of depreciation and obsolescence factors.

(f) A complete examination should be made of all factors associated with raw materials. This would involve inquiry as to the number of stores, their location, the method of stores keeping, the sources of stocks, purchase procedure, the method of receiving, counting and checking stores received, the issuing of stores for production, the authority for doing so, methods of delivery, and the checking of returns. Stocktaking procedure would be the subject of further inquiry including how often it was taken and when, the method of carrying out the work, the staff employed, the compilation of the stock sheets, and the certification to such.

(g) Attention should then be turned to the various labour factors involved. Firstly, there would be overall considerations as to the number of employees, the classes of labour, and the type of work performed by each class. Methods of foremanship and supervision should be examined, and personnel problems being faced should be noted. Welfare facilities available would be important, though this may already have been encountered in connection with service departments.

9. *Production Records.*

Having obtained a sufficiently clear grasp of the whole of the production factors involved, attention can be turned to the various records that are in existence. These could be subdivided as follows:—

(a) *Raw Materials.*

Records relating to the procedure already examined in relation to the receipt, preservation and issuing of raw materials should be inquired into. These would include the methods of purchasing and the various forms and records relating thereto including purchase orders, follow up slips, quotation requests and copies of goods received notes. Other copies of the latter received by the store would probably find their way either to the purchasing, accounting or cost accounting sections, and the method of tying these, together with the inspection certificates, to the invoices should be traced. The existence or otherwise of stock ledgers should be confirmed, and if they are in existence the type of entry and the method of entering would be important. Methods relating to issue of materials from the store should be followed from the time books of materials issues are forwarded to the works manager to the stage they come through the store, are received in the cost office, entered in the stock ledgers, and finally summarised in the materials summary form. The final stage in the recording of raw material costs would be the method of charging these to the jobs, including both the method of pricing and the type of cost sheet or other cost record. Some further general consideration may be given to the possibility of stores being issued without the knowledge of the storeman or without going through the store, and the general adequacy or otherwise of the whole stores routine.

(b) *Labour.*

Usually the best method of learning vital factors in relation to this element of cost is to take a time card and ascertain how it is issued, who prepares it, how it reaches the man, what he has to do with it, how the entries are made, where it goes when it leaves the man, who checks the entries, who returns it to the cost office, what method of carrying out the calculations is followed, whether any standards are employed, and, if so, how they are calculated, by whom, and by whom they are checked, and finally how and in what form they are transferred to the Payroll Summary. The method of charging labour costs to the various jobs in the case of direct labour and to the indirect labour expense accounts for the remainder should be examined. It may be necessary to spend some time upon the question of indirect labour, because this may be an important factor in the installation. The paying procedure may not be a fundamental factor to the cost accountant, but some general knowledge of the procedure involved will in most cases be found helpful.

(c) *Factory Service.*

The charges relating to this element of cost will come through raw material requisitions, time cards, the voucher register or purchase journal, and, for some charges like depreciation, through the general journal. These should be traced, because obviously they will be fundamental to an understanding of the whole question of factory expense, which can be one of the most difficult with which the cost accountant will be faced. Full thought should be given as to whether factory expense is to be apportioned on an actual or predetermined basis. If the latter, it would be necessary to ascertain how a budget is to be prepared in respect of all items included in factory expense, and how and by whom the work is done. Where the factory expense rate is pre-determined, an estimated production of some kind must be decided upon. Inquiries should be instituted to find what production unit is used as a basis, and how this is arrived at. If normal capacity is involved, some knowledge of what is regarded as normal capacity is essential. The question of direct charges to departments also warrants consideration and finally the desirability and practicability of the use of machine time for spreading expense should be learned.

10. *Sales Survey.*

Factors relating to sales and distribution may not affect the cost accountant in his installation to the same extent as production, and, indeed, for some considerable period may affect him very little, but a clearer conception of the whole organisation is obtained if adequate knowledge is gained of all such matters. Attention should be directed towards such factors as the analysis of product classes sold, the methods of distribution, the locality of distribution, warehousing operations and the method of covering finished stocks. It is important to know whether budgets are prepared to cover estimated sales and also selling expenses. A knowledge of the type of selling would involve questions as to salesmen, mail orders, wholesale and retail distribution and such problems. Advertising appropriations, and advertising media would be covered. In addition to the foregoing the general tie-up between production and sales may be very important, and may be valuable information later when the question of statements for management comes under consideration. At least some inquiry should be made in relation to such factors as sales research. Finally, the matter of sales records would be of importance. The method of covering warehouse stocks, receipt of orders, the recording of deliveries, the preparation of sales invoices and stocktaking of finished and warehoused goods should be investigated.

11. *Administrative, Accounting and Financial Factors.*

Most of these factors can be obtained through the administrative, executive and the general accounting records of the company. Some inquiry should be made in relation to the general administrative methods in vogue, and then attention can be directed towards accounting factors. These would include the accountancy methods adopted, a statement of the general accounting plan, the various ledgers and books of accounts, the classification of accounts, the length of financial periods, the times of financial closing of the books, and methods of balancing. Finally, the inquiry could cover such financial aspects as the capital structure, the methods of financing, the tie-up between factories, or with subsidiaries, and policy in respect of capital expenditure.

2. Planning.

When a thorough grasp of all vital information has been obtained, a commencement can be made in the planning of the installation. The ultimate success of the whole scheme may well depend upon the careful thought given to this stage of the work. It is necessary to reach the position where the complete system can be foreshadowed, and then attention can be directed towards the manner in which the work will be carried out and the methods that will be employed. It is essential that close thought be given to a broad outline of the whole cost control scheme, and this would include decisions relating to the following factors:—

1. *The Type of Cost System to be Installed.*

This may be job order, process or standard costs, or some combination of such.

2. *The Scope of the System.*

The degree of detail to be covered and the factors which will be embraced by the system must be established.

3. *The Cost Statistics and Statements desired.*

Decisions in relation to this matter will assist in giving a clear picture as to what the installation should cover. The preparation of necessary statistics is one of the most important aims of a cost system and attention must be given as to whether such factors as monthly Profit & Loss A/cs. are to be covered.

4. *The Flow of Cost Records.*

This will be one of the most difficult factors to which attention must be given. Nothing can destroy a cost installation more quickly than difficulty in obtaining the requisite information upon which cost data should be prepared. This makes for delays, which in turn, may mean managerial impatience because information flows through when it is too late to be of any use.

5. *Functional Responsibility for Cost Records.*

It is advisable to be definite in terms of functional responsibility, so that attention can be directed immediately when records arrive late or in an unsatisfactory form.

6. *Tie-Up Between Factories and Departments.*

This is necessary because of the interplay of accounts affecting more than one factory and the necessity to cater for factory services in respect of more than one department. Furthermore, this may be a vital factor in the cost records.

7. *Production Control.*

As stated earlier this may be of such importance that the whole production system may have to be changed or re-vitalised. If this be found necessary, it may be advisable to face this problem first and not to proceed with the cost installation until a satisfactory production control procedure has been established. The whole subject of production planning and control is dealt with in Chapters 37 and 38.

8. *Sales Analysis.*

If it is almost certain that statements involving gross profit in relation to sales product classifications will be finally calculated, a satisfactory code and classification must be planned.

9. *Accounting Methods.*

The general accounting and cost accounting records must be planned in at least overall fashion. Careful consideration will be necessary in connection with the classification of accounts and the number and type of ledgers.

10. *Mechanical Methods Necessary.*

In order to carry out the installation work and see that the various statistics flow through to the cost office some mechanical assistance may be essential. This may take the form of punched card machines, accounting or tabulating units, or finally adding machines.

11. *Probable Requirements in Costing Personnel.*

The selection of a suitable person for cost accountant and of the cost accounting staff should be made carefully. Furthermore, provision must be made for such other assistance as is desirable.

12. *General Control over Materials, Labour and Expense.*

This may involve flow charts to cover records, functions and responsibility in relation to material, labour and expense.

13. *Finally, a Time Table of the Installation should be prepared.*

In this connection there are two methods of carrying out the work firstly, planning and getting every phase of an installation ready and commencing all phases of the work from a certain date, secondly covering the installation piecemeal, by instituting and perfecting one aspect before others are attempted.

3. Installation.

The actual installation work should not occasion undue difficulties if the previous stage of planning has been carefully accomplished. It has already been pointed out that before the cost installation is commenced, the whole production control procedure might have to be covered. If this is, however, entirely satisfactory, the installation work may take the following form:—

(a) *Materials.*

1. Prepare, procure, and make available all necessary forms, documents and records to those employees who will be using them.
2. See that all stores are in order and arrange for safe custody and care of materials.
3. Install the purchasing procedure including requisite records.
4. Arrange the receiving and testing procedure relating to inwards goods, and institute the records relating thereto.
5. Cover materials requisition procedure, and the preparation of all documents covering such.
6. Arrange for all other stores records, bin cards, stores ledgers, and any necessary checking of records.
7. Set up the procedure for the entry of stock movements, and see that the information is kept current.
8. Lay down procedure relating to perpetual inventories and physical stocktaking.

(b) *Labour.*

1. Arrange for the issue of time cards, the necessary entries thereon, checking of such, and the routing of these cards through to the final destination of the cost office.
2. Institute payroll summaries and the division between direct and indirect labour.
3. Where necessary suggest desirable alterations in the paying procedure.

(c) *Factory Expense.*

1. Arrive at a decision as to whether expenses are to be predetermined or actual. If the former decide on the level of capacity.
2. Arrange for budgets to be prepared covering all factory expenses.
3. Decide on all departmental rates for period.
4. Ensure the keeping of records to cover machine times where necessary.
5. Put in hand procedure for accumulation of actual factory expense.
6. Decide upon the method of charging and the manner of dealing with over or under absorbed burden.

(d) *Cost Procedure.*

1. Arrange for a careful check to see that all necessary forms, records and ledgers are available before the installation commences.
2. See that the data for the preparation of the plant ledger become available and that all relevant details are entered therein.
3. Cover the routing of all cost records.
4. See that responsibility for entry of all cost records is clear.
5. Arrange for the charges to cost sheets of materials, labour and expense.
6. Lay down the procedure to be adopted in the finalisation of job or production orders, together with procedure relating to transfers between departments.
7. Commence the specific use of the voucher register or purchase journal.
8. Cover all finished stock records.
9. Arrange for the calculation and entry of cost of sales figures.
10. Arrange for the preparation of statements and statistics as soon as the cost data flow through.

(e) *Sales.*

1. Make a commencement with the completion of forms and statistics to be supplied.
2. Arrange for the procedure to be adopted to make the statistics available.
3. Prepare a budget of selling expense.
4. Arrange for the accumulation of selling expense.
5. Finally apportion selling expense.
6. Facilitate the flowing through of information which will finally make possible preparation of sales, cost of sales, gross profit and if need be, net profit statements.

(f) *Administrative, Accounting and Financial.*

1. Arrange for the necessary cost accounting personnel.
2. Prepare the classification of accounts.
3. Arrange for initial entries in the necessary ledgers, forms, etc.
4. Lay down procedure for tie-up between accounting and costing records.
5. See that information flowing through is finally recorded in accounting terms.

(g) *Statements Desired.*

1. Decide upon and as soon as possible prepare the necessary statements for :—
   (a) the board of directors,
   (b) the general manager,
   (c) the various executives,
   (d) shop committees,
   (e) departmental supervisors,
   (f) foremen.

The exact order in which the foregoing should be attempted depends upon the individual circumstances involved. Thus the first thing to do may be to arrange for the necessary cost accounting personnel. The order should be decided upon and if possible a time table introduced to see that the programme keeps to schedule.

4. Operating and Perfecting.

When the installation work has proceeded up to a satisfactory stage, a commencement can be made to operate the system. This may be done by allowing certain portions of the system to begin at different times, or, alternatively, arrangements may be made for stocktaking to be carried out on a certain date, and a commencement of the new installation made immediately afterwards. This latter practice would give an opportunity to clear up some of the previous difficulties and weaknesses, and enable the installation to commence with a fresh start.

Whilst the system is operating constant attention must be given to the results being achieved, the weaknesses being disclosed and the alterations desirable. The initial period when the installation is actually in operation is one which makes the very fullest demands upon the cost accountant's time and patience. He must be a teacher, and must be ready to explain afresh what is desired and the manner in which it can be obtained. It is most unlikely that changes will be unnecessary, because the additional experience gained in actual operation will disclose methods of improvement, short cuts, and additional advantages to be gained.

As time goes by more improvements can be instituted to ensure that the cost installation covers more and more adequately its two primary functions—firstly, to give management the information desired, and, secondly, to make available costs of all products.

It is not intended to convey that the foregoing plan is a model upon which even most installations could be attempted. Rather it seeks to illustrate the general approach to the question of cost installation, which may be restricted or amplified, according to the complexities and demands of the actual organisation being covered.

In conclusion, the following points are recommended to the attention of those interested in cost installation:—

1. Co-operation on the part of executives and sub-executives is the biggest single factor in ensuring success.
2. Always bear in mind that the greatest goal must be managerial information.
3. Never take out figures for the sake of taking them out—beyond certain basic figures all new figures should have managerial importance.
4. It sometimes pays to be unorthodox—providing one is certain of one's ground.
5. It is wise to remember what machines can do nowadays.
6. Planning should be accomplished with such care that changes are kept to a minimum, but if they are necessary they should be made.
7. The advice and help of the technical staff can smooth away many problems.
8. Aim at the minimum dislocation in production and the minimum change in records, consistent with doing the job.
9. If need be, arrange for a piecemeal approach. Cover one object at a time, and accomplish it.
10. The best cost accounting system is the simplest one that will do the job in satisfactory fashion.

CHAPTER 36.

TIME AND MOTION STUDY.

Importance to Cost Accountants.

Whilst there is no obligation upon the cost accountant to be an expert in time and motion study, it is necessary for him to understand the main principles involved, and the methods of working. The carrying out of the job properly is a matter for the specialist and requires a great deal of study. Nevertheless, there are many phases of time and motion study which are met by the cost accountant, and, indeed, which branch into his work. In the case of Standard Costs, for example, it will frequently be found that where time and motion studies have been made in relation to labour, the wage figure arrived at can be used for the preparation of labour standards. This condition is often found in textile mills, where bonus rates have been scientifically set. These rates conform to a specific formula and lend themselves to adoption as Labour Standards.

In certain cases, moreover, time and motion studies are related to units of performance, and these may in turn be used by the production engineer for production planning purposes. As far as the cost accountant is concerned he may decide to proceed a further step and use such units for the spread of factory expense.

It will be seen, therefore, that the work of the cost accountant may be hindered if he is unable to appreciate at least in general fashion, the principles behind time and motion study, the method of its operation, and the effect upon labour conditions and rates.

History and Development.

The originator of time and motion study was Frederick W. Taylor, who first experimented in this connection whilst he was foreman of a machine shop with the Midvale Steel Co., U.S.A., in 1881. His first effort in this regard is described in his book "Shop Management" (page 148) in the following terms:—

> "It was simpler to time with a stop watch each of the elements of the various kinds of work done in the place and then find the quickest time in which each job could be done by summing up total times of its component parts than it was to search through the time records of former jobs and to guess at the proper time and price."

Taylor pursued his inquiries because he considered it a short cut to high wages and low labour costs. As he proceeded, he came to realise more and more the value of scientific methods of determining production standards. After providing the world with proof of the validity of his contentions, his work was carried on, particularly by Merrick and the Gilbreths.

Since Taylor's time, the term "Job Standardisation" has been coined to cover the development and recording of the one best way of carrying out the work to be covered. This naturally includes an investigation into the best method without overworking the operator. When this best method has been determined it is recorded, so that the operator can follow the instructions each time the work must be undertaken. Job Standardisation is therefore made up of two factors:—

1. Job analysis or evaluation—which seeks to investigate all factors concerning the job and decide how it can best be done.
2. Job specification which covers the recording of these factors upon an operation sheet.

Originally, Time Study was used by Taylor for rate setting, and later the Gilbreths adopted Motion Study for the purpose of improving methods. With the passage of time, however, the two have been combined into Time and Motion Study.

Time Study.

This may be defined as:—

The thorough scientific analysis of methods, conditions, and equipment to be used in carrying out certain work, the determination of the best manner in which it can be completed, and the recording of the time required.

The aim of Time Study is to subject each operation of a given piece of work to a close analysis in order that every unnecessary operation may be eliminated and in order to determine the quickest and best method of performing each necessary operation; also to standardize equipment, methods and working conditions; then and not until then, to determine by scientific measurement the number of standard hours in which an average man can do the job.

An average man may be defined as a man who has been working on a given class of work long enough to know it thoroughly, who is not unfitted for the work by nature, and who possesses normal intelligence and enough education to perform satisfactorily the work at hand. In general about 30% more is produced by the skilled worker than the average man when both are exerting the same effort under the same conditions.

It is of little use to establish a time value on an operation if the method of performing that operation is to be changed overnight. The operation must be studied, analysed and discussed from every angle before the time study is taken. Standardizing can take into account labour saving tools, jigs and fixtures, most efficient cutting speeds and feeds, arrangement of the work bench, material handling equipment, methods and motions used by the workman in doing the job, and working conditions, such as light, heat and ventilation.

Motion Study.

Motion Study is related to Time Study, but has more reference to the sequence and the basic motion of the worker in relation to each operation. It has been defined by the originators, F. B. & L. M. Gilbreth, "Applied Motion Study," page 43, as consisting of:—

> "Dividing work into most fundamental elements possible; studying these elements separately and in relation to one another; and from these studied elements, when timed, building methods of least waste."

Stages in Time and Motion Study.

It will be seen that there are four distinct stages in time and motion study:—

1. *The Best Method of Performing the Operation.*

This is carried out scientifically and the investigation would include the proposed methods, materials, tools and equipment to be used. It should be realised that all these factors have to be considered in relation to the circumstances operating. The quickest method may not necessarily be the most economical. Very often two desirable factors may conflict. Thus one metal might be easier to work and just as suitable, but it may be more costly.

2. *Standardisation of the Operation.*

When the one best method has been determined, the whole of the operation should be recorded, so that there will be a permanent record of the standardised operations.

3. *Setting the Time Standard.*

This involves time study to see how long a chosen worker (for example, an average worker) would take to carry out the work using exactly the method which has been laid down. Many principles are involved in setting these time standards.

4. *Training the Operator.*

The technique of time and motion study is not considered complete until the operator has been trained in the manner in which the work should be carried out. This is particularly important where bonus schemes are in operation, as the training of the worker in the best method to carry out the operation gives him the opportunity of earning the bonus associated with the work.

Taylor's Explanation of Time Study.

Taylor himself wrote a definition and an explanation of Time Study, which appears in a report of a sub-committee on Administration of the A.S.M.E (U.S.A.), "The Present State of the Art of Industrial Management," (Tran. A.S.M.E., Vol. 34, pp. 1197-98, 1912).

> " Time Study is the one element in scientific management beyond all others making possible the " transfer of skill from management to men." " Time Study " consists of two broad divisions, first, analytical work and, second, constructive work.
>
> The analytical work of time study is as follows :—
>
> (a) Divide the work of a man performing any job into simple elementary movements.
>
> (b) Pick out all useless movements and discard them.
>
> (c) Study, one after another, just how each of several skilled workmen makes each elementary movement, and with the aid of a stop watch select the quickest and best method of making each elementary movement known in the trade.
>
> (d) Describe, record and index each elementary movement, with its proper time, so that it can be quickly found.
>
> (e) Study and record the percentage which must be added to the actual working time of a good workman to cover unavoidable delays, interruptions, minor accidents, etc.
>
> (f) Study and record the percentages which must be added to cover the newness of a good workman to a job, the first few times that he does it. (This percentage is quite large on jobs made up of a large number of different elements composing a long sequence infrequently repeated. This factor grows smaller, however, as the work consists of a smaller number of different elements in a sequence that is more frequently repeated.)
>
> (g) Study and record the percentage of time that must be allowed for rest, and the intervals at which the rest must be taken, in order to offset physical fatigue.

The constructive work of Time Study is as follows:—

(h) Add together into various groups such combinations of elementary movements as are frequently used in the same sequence in the trade, and record and index these groups so that they can be readily found.

(i) From these several records, it is comparatively easy to select the proper series of motions which should be used by a workman in making any particular article and, by summing the times of these movements and adding proper percentage allowances, to find the proper time for doing almost any class of work.

(j) The analysis of a piece of work into its elements almost always reveals the fact that many of the conditions surrounding and accompanying the machines used in connection with it need perfecting, and that the sanitary conditions are bad, etc. And knowledge so obtained leads frequently to constructive work of a high order, to the standardization of tools and conditions, to the invention of superior methods and machines."

Since Taylor inaugurated his methods, complaints have been made that he endeavoured to force the worker to produce more work by the use of methods which were actually found to be not scientific, and a controversy has developed in this regard. It is therefore necessary to ascertain how improved production arises if "sweating" is not introduced. The improvement is usually taken as arising from:—

1. Improved and standardised working conditions.
2. Improved methods of work.
3. The incentive of increased earnings.
4. Scientific training.
5. Greater interest in and application to the work.

Motion study originated with the Gilbreths—Frank B. Gilbreth with a knowledge of engineering, and his wife, Lillian M. Gilbreth, with a training as psychologist. They developed systematically the activities covering a very wide range. They paid particular attention to fatigue, monotony and the transfer of skill and work for the handicapped, all of which factors were dealt with in publications by them. They also developed techniques in operation to-day, particularly the process chart, micro-motion study, and the chronocyclegraph. It should be noted that motion study is most concerned with the elimination of waste effort and the development of skilful motions rather than with unnecessary or undue speeding up of operations.

Technique of Time and Motion Study.

This involves:—

1. An initial recognition and examination of what is to be done.
2. A recognition of the best method of carrying out the time and motion studies.
3. The analysis of the work into elementary operations.
4. Thorough examination of the various work elements.
5. Decision regarding the elimination of waste processes.
6. Tabulation of the desirable sequences and operations.
7. Calculation of allowances for fatigue and such factors.
8. Determination of wage payable, including bonuses where these are applicable.
9. Recording of the acceptable method for doing the job as a permanent training and educational record.

These factors can be considered as involving the following steps:—

1. *The Standardisation of Working Conditions.*

This should precede the standardisation of functions. Generally there are two phases; firstly, the standardisation of general working conditions and, secondly, the standardisation of local conditions at or immediately in the neighbourhood of the machine. A simple illustration will indicate the essential nature of these conditions. If the quality of the material upon which work is to be carried out is constantly varying, obviously differences in times would be almost certain to result. The quality of material is usually something which is not under the control of the employee and may not be within the jurisdiction of the foreman. Similarly, such factors as illumination are important. If the lighting is bad, results may not be satisfactory. It may be necessary to investigate transportation equipment for the handling of material, and, in addition, the facilities for storing the materials at or near the machine. If standard times are to be relied upon, standard conditions are essential. Once these conditions are obtained they should be maintained.

2. *Time and Motion Study.*

This can be carried out by:—

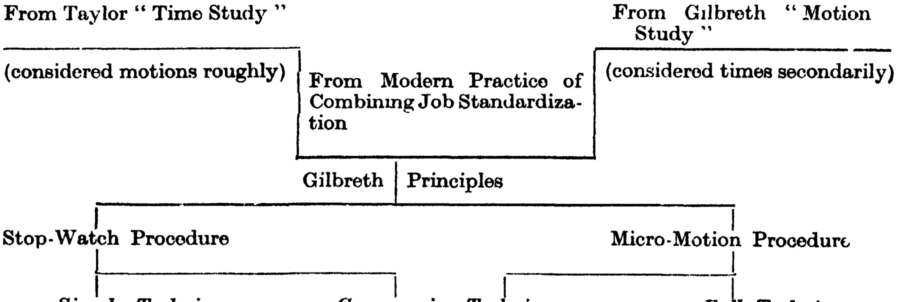
(a) Simple time study and measurement with a stop watch in the shop.

(b) Micro-motion study and measurements with a motion picture camera, or micro-chronometer in a laboratory.

(c) A compromise between (a) and (b).

These factors have been charted by Alford in "Principles of Industrial Management" (Ronald Press Co., pages 322, 323) as under:—

“ RELATIONSHIP OF TECHNIQUES.


From Taylor " Time Study "
(considered motions roughly)
From Gilbreth " Motion Study "
(considered times secondarily)
From Modern Practice of Combining Job Standardization
Gilbreth
Principles
Stop-Watch Procedure
Micro-Motion Procedure

Simple Technique	*Compromise Technique*	*Full Technique*
Decimal Stop-Watch Simple Motion Record Time Observation Sheet Instruction Card	Decimal Stop-Watch Motion Chart with Time Scale Instruction Card (Only possible to those trained in full technique)	Micro-Chronometer and Motion Pictures Chart Date Sheets Two or More Simo Charts Slow Pictures

Comparative steps in the " simple " and " full " techniques :—

Stop-Watch Procedure	*Micro-Motion Procedure*
1. Process or Departmental job	1. Process or Departmental job.
2. Operations.	2. Operations.
3. Elementary operations or cycles of motions.	3. Suboperations or cycles of motions.
4. Motions (can and should be studied to some extent but not timed).	4. Therbligs.
	5. Variables.

Comparative features in the “ simple ” and “ full ” techniques :—

Stop-Watch Procedure	*Micro-Motion Procedure*
1. Requires less elaborate measuring equipment.	1. Micro-motion records nearly all conditions which affect work, excepting sound, and that could be recorded if important.
2. Requires less highly specialized experience as prerequisites on part of analyst.	2. Records do not lose in dependability as time passes. It is possible to pick out, study and regroup elements at any time without repeating performance.
3. Is easier to use in shop.	3. Emphasis is placed on method, time being by-product.
4. Attracts less attention and creates less disturbance. Therefore there is less need for special motion study laboratory.	4. Time and motions are recorded automatically and more accurately.
5. Is sufficiently accurate and adequate for many practical purposes, particularly if analyst has been trained in micro-motion.	5. Films and models, visual records of best practice, may be made for teaching.
6. Gives sufficiently reliable record for many purposes if simple motion study is properly made.	6. Human judgment is reduced to minimum.
	7. Record provides permanent basis for accurate comparison and study, not approached by any other method. It is claimed also that micro-motion studies can be made at equal or less cost than stop-watch studies.”

Actually work in this connection involves answers to the following questions:—

1. Why should the work be done ?
2. What is to be done ?
3. How is it to be done ?
4. Who is to do it ?
5. Where is it to be done ?
6. When is it to be done ?

In obtaining answers to these questions process and operation analyses are carried out and various charts are used. These are devices for recording processes for the purpose of improving them. A commencement is usually made with the raw material entering the factory and every stage of its operation is recorded. For this purpose the Gilbreths originated a set of symbols, a copy of which is shown in Figure No. 118 (F. B. & L. M. Gilbreth, “Process Charts” (Trans. A.S.M.E., Vol. 43, pp. 1818, pages 1029/50, 1921)). These symbols were given the name of Therbligs, which, of course, is the reverse spelling of Gilbreths. See Figure No. 119.

Obviously, the whole of the operations involved are examined in the utmost detail. The stop watch is frequently used, but, of course, is subject to the limitations of the eye. Micro-motion films can be used to record greater detail where necessary. Very often, a number of workmen are used to carry out the operations and comparisons are made of the results.

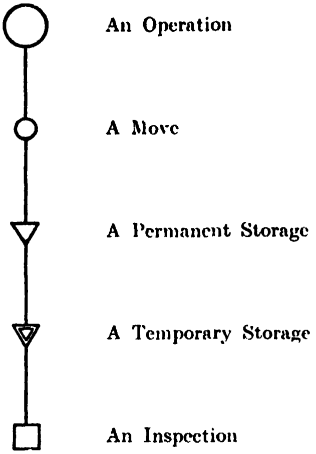
Methods of Time and Motion Study.

These involve the use of :—

1. Process Charts, including flow types, man and machine and operator types.
2. Micro-motion Study, covering work elements, motions or therbligs and movements.
3. Time Study, involving measurement units, job conditions, standardisation of conditions and performances, reports on results and bonus incentives.

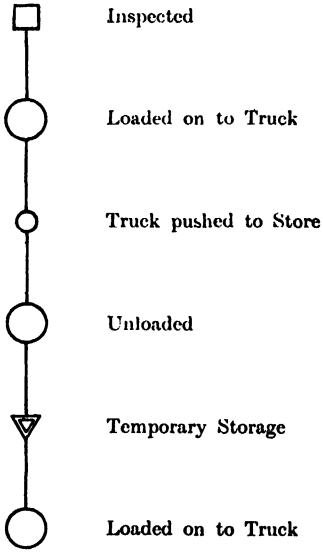
FIGURE No. 118.

COMMON PROCESS CHART SYMBOLS.



Thus·

An Engine Casting :—



Time for each operation would be inserted and a summary shown at the bottom of the Chart.

FIGURE No. 119.

THERBLIGS.

Name of Therblig	Symbol	Explanation Symbol Suggested By—	Colour
Search		Roving Eye as if Searching	Black
Find		Eye Fixed on Object	Dark Grey
Select	→	Reaching for Object	Light Grey
Grasp	∩	Hand Open for Grasping	Lake Red
Transport Loaded		Hand with Something in it	Dark Green
Position	9	Object being Placed by Hand	Dark Blue
Assemble	#	Several Things put Together	Dark Violet
Use	U	First Letter-Word " Use "	Purple
Dis-Assemble		One Part of Assembly Removed	Light Violet
Inspect	0	Magnifying Lens	Burnt Ochre
Pre-Position	8	A Ten-Pin	Sky Blue
Release Load		Dropping Content from Hand	Carmine Red
Transport Empty		Empty Hand	Olive Green
Rest to overcome Fatigue		Man Seated as if Resting	Orange
Unavoidable Delay		Man Stumbling Unintentionally	Yellow Ochre
Avoidable Delay		Man Lying Down on Job	Lemon Yellow
Plan		Man—Hand at Brow—Thinking	Brown

Flow Process Charts.

These involve a complete record of the sequence of operations within a process. In this connection, there is a threefold division:—

1. " Set Up." 2. " Do." 3. " Clean Up."

The Process Chart therefore sets down every movement in getting ready, carrying out and completing an operation. The objective is, of course, to analyse these so that elimination can be made of every unnecessary or wasteful motion and alteration of every motion which is uneconomic or can be improved.

It is essential to realise particularly at the outset, that all possible detail should be included. It is better to include too much than not enough.

A Process Chart should cover:—

1. Full analysis and recording of all steps involved.
2. Full details, such as distance and time, relating to the steps and moves.
3. Separate recording of temporary and permanent storages.
4. Symbols, numbered progressively.
5. A summary of—
    (a) Total distances involved.
    (b) Total time involved.
    (c) Number of temporary and permanent storages.
    (d) Number of operations included.
    (e) Total of idle or wasting time.
    (f) Causes of idle or wasting time.
    (g) Division of time for each of three major steps—" Set-Up," "Do," "Clean Up."

It should facilitate consideration of such factors as:—

1. Is it necessary to do this—can the operation be eliminated or reduced ?
2. What must be done to achieve the objective ?
3. How can this *best* be accomplished—having in mind the best conditions which can be given and all other relevant factors ?
4. Who should do the work ?—Care should be taken in selecting not the best worker but the one who is the most suitable for the test.
5. The work should be carried out where it can best be accomplished, having in mind the general flow of operations.

Process Charts are most useful where the cycle of operations is long and by no means repetitive. It is a broad measure not an accurate gauge.

Very often it is desirable to prepare a first Process Chart having the actual operations and then, alongside, the amended list with all avoidable sequences excluded.

Man and Machine Process Charts.

These adopt two parallel columns—the first to show the operations of the "man" and the second, the "machine." Thus in the first the whole of the moves of the man are adequately and in detail recorded—all that he does and how he does it. In the machine column, particulars relating to set up, running, stopping and idle machine time would be shown. A comparison of these two may suggest all kinds of improvements. If, for example, a machine is idle because an operator has to leave the machine while he goes to take delivery of some material, inquiry should be made. This may be a good thing or a bad one. Again attention should be paid not only to the "Do" operation, but also the "Set Up" and "Clean Up" functions.

Operator Charts.

These are somewhat similar to man and machine charts, but instead of using the parallel columns for "Man" and "Machine," they are used to record the motions and operations of the left and right hand of the operator. These involve studies of hand motions.

Hand Motions.

The object of a study of hand motions is to ascertain whether they are economical. With careful attention to rhythm of movement, precision of movement and speed, the use of two hands simultaneously, together with scientific attention to all aids, much can be accomplished.

Hand motions are divided into:—

1. Finger Motions.
2. Motions involving fingers and wrist.
3. Motions involving fingers, wrist and forearm.
4. Motions involving fingers, wrist, forearm and upper arm.
5. Motions involving fingers, wrist, forearm, upper arm and shoulder.

It is a fundamental principle always to use the lowest motion in preference to any other—finger motions being the lowest.

Maximum and normal areas have been worked out for both left and right hands. The former is arrived at by extending the right arm from the shoulder and describing an arc across the place of work. The latter can be shown by resting the elbow on the edge of the work place and describing an arc, using the elbow as a pivot. If the maximum area is used, number four motion will be operated. It can be exceeded only by using number five. In the case of the normal, only the first three motions are needed. The lower the motion classification, the less the fatigue, so that it follows that if operations can be confined to the normal, this is better than invoking the maximum. Thus, if a necessary tool is placed within the scope of normal movement, it is, in the vast majority of cases, better than within maximum movement. Similarly, if within the latter, this would be better than outside it

Other factors could be enumerated, such as:—

1. Tools, etc., should be placed preferably within the normal arc and at a height just slightly above the point of use.
2. They should be arranged in sequence of use.
3. Arm motions should be made in opposite directions—not the same direction—and should be symmetrical.

Stop-Watch Technique.

This involves:—

1. Get —This starts when the body member commences to move towards its object and it stops when that body member grasps the object.
2. Place —commences with the movement to place the object and stops when the object has been placed by releasing the grasp.
3. Do —carrying out the actual work processing—from the moment it is commenced until the actual process is finished.
4. Delay—results when a lack of action is met. It may be avoidable (and can possibly be eliminated) or unavoidable (and probably cannot be eliminated).

Principles of Motion Economy.

Certain principles of motion economy have been developed by Barnes. "Motion and Time Study," pages 387/388:—

" Principles of Motion Economy—

1. The two hands should begin as well as complete therbligs at the same instant.
2. The two hands should not be idle at the same instant except during rest periods.
3. Motions of the arms should be in opposite and symmetrical directions, instead of in the same direction, and should be made simultaneously.
4. Hand motions should be confined to the lowest classification with which it is possible to perform the work satisfactorily.
5. Momentum should be employed to assist the worker wherever possible, and it should be reduced to a minimum if it must be overcome by muscular effort.
6. Continuous curved motions are preferable to straight-line motions involving sudden and sharp changes in direction.
7. Ballistic movements are faster, easier and more accurate than restricted (fixation) or " controlled " movements.
8. Rhythm is essential to the smooth and automatic performance of an operation and the work should be arranged to permit easy and natural rhythm wherever possible.
9. Definite and fixed stations should be provided for all tools and materials.
10. Tools, materials and controls should be located around the work place and as close in front of the worker as possible.
11. Gravity feed bins and containers should be used to deliver the material as close to the point of assembly or use as possible
12. " Drop Deliveries " should be used wherever possible.
13. Materials and tools should be located to permit the best sequence of therbligs.
14. Provisions should be made for adequate conditions for seeing.
15. The height of the work place and the chair should preferably be so arranged that alternative sitting and standing at work are easily possible.
16. A chair of the proper type and height to permit good posture should be provided for every worker.
17. The hands should be relieved of all work that can be performed more advantageously by the feet or other parts of the body.
18. Two or more tools should be combined wherever possible.
19. Tools and materials should be pre-positioned wherever possible.
20. Where each finger performs some specific movements, such as in typewriting, the load should be distributed in accordance with the inherent capacities of the fingers.
21. Handles such as those used on cranks and large screwdrivers should be designed to permit as much of the surface of the hand to come in contact with the handle as possible.
22. Levers, crossbars, and handwheels should be located in such positions that the operator can manipulate them with the least change in body position and with the greatest mechanical advantage."

3. *Analysis of the Data and Determination of the Standard.*

Three major attitudes of mind are necessary to effect improvements:—

1. Critical examination.
2. Close inspection.
3. Practical application.

When all the information is available, consideration can be given to a number of factors before the standard is determined. These have been outlined by Barnes ("Time and Motion Study," pages 37/38) :—

" I. *Materials* :

1. Can cheaper material be substituted ?
2. Is the material uniform and in proper condition when brought to the operator ?
3. Is the material of proper size, weight, and finish for most economical use ?

II. *Materials Handling* :

1. Can the number of times the material is handled be reduced ?
2. Can the distance moved be shortened ?
3. Is the material received, moved and stored in suitable containers ? Are the containers kept clean ?
4. Are there delays in the delivery of material to the operator ?
5. Can the operator be relieved of handling materials by the use of conveyors ?

III. *Tools, Jigs and Fixtures* :

1. Are the tools the best kind for this work ?
2. Are the tools in good condition ?
3. If metal-cutting tools, are the cutting angles of the tools correct and are they ground in a centralised tool-grinding department ?
4. Can tools or fixtures be changed so that less skill is required to perform the operation ?
5. Are both hands occupied by productive work in using the tools or fixtures ?

IV. *Machine* :

A. Setup :

1. Should the operator set up his own machine ?
2. Can the number of setups be reduced by proper lot sizes ?
3. Are drawings, tools and gauges obtained without delay ?
4. Are there delays in making inspection of first pieces produced ?

B. Operations :

1. Can the operation be eliminated ?
2. Can the work be done in multiple ?
3. Can the machine speed or feed be increased ?
4. Can an automatic feed be used ?
5. Can the operation be divided into two or more short operations ?
6. Can two or more operations be combined into one ?
7. Can the sequence of the operation be changed ?

V. *Operator* :

1. Is the operator qualified to perform this operation ?
2. Can unnecessary fatigue be eliminated by a change in tools, fixtures, layout, or working conditions ?
3. Is the base wage correct for this kind of work ?
4. Is supervision satisfactory ?
5. Can the operator's performance be improved by further instruction ?

VI. *Working Conditions* :

1. Are the light, heat and ventilation satisfactory on the job ?
2. Are wash rooms, lockers, rest rooms, and dressing facilities adequate ?
3. Are there any unnecessary hazards involved in the operation ?
4. Is provision made for the operator to work in either a sitting or a standing position ?
5. Is the length of the working day and the rest periods set for maximum economy ?"

Experience and care are necessary in deciding upon the standard.

This is a matter for the specialist, as many of the factors involved have been the subject of controversy over a period of years. Furthermore, an allowance for fatigue and delays should be scientifically set. The exact nature of the work will determine just what this allowance should be. Also due attention must be paid to the conditions operating within the factory itself. The greatest care is necessary because the setting of unfair standards may provoke all kinds of trouble and may at the outset result in a lack of confidence in the whole method. The result should be fair to the management and to the employee.

4. *Application of the Standards.*

This involves, firstly, the recording of instructions concerning the best method to carry out the work, together with all explanations desired, and, secondly, all necessary training to fit the worker to carry out the work and to have a reasonable chance of matching the standard times laid down. Usually, time and motion study is associated with bonus rates, and the whole scheme may break down unless the worker is enabled to earn a reasonable bonus for proportionate work.

Group Studies.

Where the work carried out by a number of individuals can best be studied by treating all the operations together, group rates are sometimes worked out. These, later, form the subject of group bonus schemes. The procedure is similar to that described above, though the groups of men are taken as a composite unit.

Time Study Department.

Only in exceptional cases will it be found that time study operations can be carried out and completed and there is no further call for such. Where there are any changes in operations, extension of work, or changes in conditions, further time studies become essential. Usually a time study department is set up after the expert has set the initial rates, and brought the scheme to a working pitch. Very often the expert trains the time study men so that they can carry on the work which he has inaugurated. The work is frequently difficult and demands high qualities of perseverance, tact, judgment, creative planning, analytical ability, and, above all, common sense. A knowledge of psychology is a valuable attribute. An engineering training is always helpful and frequently essential.

The continued success of work previously carried out can often depend upon the ability of the time study men carrying on. They should be given all the assistance they desire from the Factory Manager, Production Engineer and the Cost Accountant, as the information which they are able to give will be of the greatest value. Much can be learned by the Cost Accountant if he associates himself with time study men and endeavours to get a general knowledge of their technique and methods. In such a way he will be able to understand more fully the results they show, and, furthermore, will gain a greater appreciation of the potential value which can be drawn from their figures in relation to the work which he has to carry out.

Wage Incentive Plans.

In dealing with wage incentives, the following factors should be noted:—

1. Incentives should be preceded by a complete study of all occupations affected. This is best accomplished by Job Evaluation.
2. Job Evaluation is an appraisal by management of the various occupations with a view to standardizing and stabilizing these within the industry. It involves examination of and decision relating to these occupations so as to facilitate payment of wages fair and equitable according to the skill, responsibility and other mental and physical qualities involved and an appreciation of working conditions operating. Job Evaluation deals with jobs, not with operations.
3. Job Evaluation involves preparation of a list of unit values as, for example, skill 100 points, responsibility 40 points etc. Considerable knowledge and judgment are required in setting these unit values.
4. A list of key occupations should be developed—occupations which are representative and are commonly known. These jobs would then be rated according to the unit values established. Each job would be examined in relation to its various characteristics—skill, responsibility, etc.—and the unit values applied. These key jobs are then used as bases to be applied to other jobs within the plant.
5. When all jobs have been completely rated, the values thus obtained should be examined in relation to the wage awards and bases operating within the industry.
6. The question of assignment of workers to various jobs must be undertaken by management. This may involve merit payments which may be fixed after merit rating or performance assessments have been obtained. Merit rating affects the individual, job evaluation the job.
7. Merit rating involves an analysis of such characteristics of workers as Knowledge of the work, Responsibility, Reliability, Versatility, Output quantity and quality.
8. Job conditions should be standardized, preferably through time and motion study.
9. The various elements of an operation should be recorded both accurately and in sequence. A stop watch is frequently all that is necessary, either with snap-back readings (the watch hand being set back at zero after each reading) or continuous readings (each reading being taken in cumulative fashion). A number of cycles should be observed, the exact number depending on the type and conditions of the operations.
10. A unit of measurement should be adopted, such as the " standard hour " or " standard minute." This, it should be noted, represents the work produced in such standard time. Thus it could be the amount of work produced by a normally effective operator under normal working conditions in a standard hour.
11. In fixing performance standards care must be taken to eliminate abnormal items, determine minimum times, ascertain the actual operator's time variances from the standard minimum time.
12. The average times obtained from the studies made should be divided by the total deviation (the variances) to ascertain selected minimum times.

The various wage incentive methods were examined in detail in Chapter No. 6.

Conclusion.

As indicated at the beginning of this chapter, an expert knowledge of this subject is not demanded of the Cost Accountant, but it is very desirable that general principles are understood. Such a knowledge will help the Cost Accountant in carrying out his own duties.

CHAPTER 37.

PRODUCTION PLANNING.

The Cost Accountant and Production Planning and Control.

Whilst the cost accountant does not have to be a production engineer it is essential that he should have at least a general knowledge of the principles involved in production planning and control. At times, his work is no more than indirectly associated with that of the production engineer. At others, the figures which he requires are so intimately bound up that the production control mechanism may even be placed under his direction.

Obviously the exact state of affairs depends upon the type of business in which he operates. Furthermore, the type and method of production planning and control also depends upon this factor. Organisations vary considerably not only in the products they manufacture, but in the type of manufacturing procedure and technique. Most businesses conform to certain general principles, but a general production procedure could not operate satisfactorily in all businesses. Not only do procedures vary, but also the length to which planning and control are taken.

One business may confine the whole of its attention to building a very big bridge; another may build products usually associated with heavy industry, such as cranes; a third may turn out chemical products; a fourth, textiles; a fifth, furniture. The list could, of course, proceed right through the whole of manufacturing industry.

In dealing with production planning and control, therefore, it seems wise to outline certain general principles, and then to take one or two industries to show how the planning and control are carried through to conclusion.

No matter what business is involved, the work of the cost accountant can be fundamentally affected by production planning and control, because obviously his figures must flow from the production departments. Anything which affects them may well affect the validity of his figures, the speed with which they are received, and the degree of detail which characterises them. As stated above, therefore, it is imperative that he should know sufficient of the principles involved to make an intelligent approach. By this means, he can perhaps best help himself in relation to those factors which impinge upon his cost figures, and, furthermore, if he is careful he may, through an analysis of cost data supplied, be able to give much valuable assistance, not only to the production control department, but also to the production manager or engineer.

Furthermore, the work of the cost accountant is closely bound up with material records. He is constantly dealing with the costs of materials. Similarly, the activities of the production control department, are intimately associated with materials—their availability. In addition, both the cost accountant and the production control have a very real interest in time cards and machine records. Machine loading, for example, seeks to keep machines operating to the best possible advantage. The records of how those machines actually run are used as a check by the production control and may be used by the cost accountant as a means of spreading factory expense.

Many of those who, in America, have contributed most to the advancement of cost accounting have themselves been engineers, and have approached the angle of costing from that of the engineer. In many cases this has developed through production control, and cost standards have some relationship to set production procedures. It is not too much to say, therefore, that the cost accountant and the production engineer have jobs which are intimately associated, and each can be of great assistance to the other. Indeed, their work in certain organisations may be such as to be complementary.

Production Planning.

As its name implies, this is simply the planning of production, but it takes into account certain fundamental considerations, viz.:—

1. What is to be made.
2. How it is to be made.
3. Where and in what sequence it should be made.
4. When the various operations should begin.

The first of these is only partly the concern of the planning department. Depending upon the type of business, the actual decision of what is to be made may be left entirely to the sales department, entirely to the production department, entirely to management, or may be the result of collaboration between all three. The question of how the manufacturing operations should be performed is, of course, definitely a production matter, as also are the third and fourth factors.

Production planning may be carried out in one of three ways:—

1. *Centralised.*

This pre-supposes a production planning department. When particulars of work to be carried out are received, it would be the function of this department, taking into account delivery dates, to decide all details in connection with its manufacture, except the actual supervision of the operations carried out, which is the direct function of the works management and through it, of the individual foremen. Thus, the production planning department would receive the order, prepare the bills of material and the production orders, analyse the various processes involved, load the various machines required, possibly prepare the stores requisitions, and inaugurate the various records, such as the Route Sheets, Job Cards, Inspection Cards, etc. In other words, it would attend to all the details involved in routing, scheduling and despatching.

2. *Decentralised.*

In many organizations, the actual planning for each department is left to the departmental foreman. He is given a copy of the orders which affect his department, together with all the necessary drawings, specifications, etc. It is then part of his job so to plan his operations as to ensure maximum production coming from his department. He must see to it that idle men and machines are kept to a minimum, and that there is always plenty of work ahead. He must also make sure that the transport of the work from one point to another coincides with requirements.

If the shop is not a very large one, he may be able to do this work himself with the aid of a clerk. Where, however, there is a lot of work involved and it is of a complex nature, it may be necessary for him to set up, within his own department, a miniature planning section.

3. *Partly Centralised.*

This is a compromise between the two methods, and very often operates with success. It is based upon the fact that frequently the planning operations are too big for the various foremen to undertake and, furthermore, it is necessary to see that there is an outside authority which can ensure co-ordination of movement between one department and another. The planning department, therefore, undertakes all planning up to a certain stage. It usually carries out all the operations necessary up to the point of loading upon the department. From this point onwards, the responsibility is that of the departmental foremen. The reason here is that it is often recognised, particularly in some shops, that the foreman is on the spot all the time, can see where planning breaks down (because even the best of planning breaks down at times) and can adopt emergency measures to overcome any difficulties or interruptions. Particularly is this so in the case of rush orders or specials, where some ingenuity and attention on the spot is much more likely to achieve success than the routine planning of an outside department.

The exact type of planning to use depends entirely upon the individual organisation. This is clearly shown by the fact that each method of planning has its firm admirers. Actually, only experience in the factory itself can show whether the existing method is the best, or whether there should be some alteration.

Definitions.

Production Planning.

This may be defined as comprising the planning, routing, scheduling, despatching and at times inspection of work, so as to co-ordinate quantity, quality, time and place in the most efficient and economical manner.

Routing—The determination of the sequence of operations. It is really the path—the shortest path—the job must follow from raw stock to finished product.

Scheduling—This is the programme time table allotted to the sequence of operations. The determination of times involved is a necessary prelude to the time table.

Despatching—The release of the work and the direction of movements in accordance with the routing and scheduling decided upon.

Stock Chasing—The function of checking up on the work to see that the time table is adhered to and the determination of remedial action where this is necessary.

The following executives and sub-executives are met in the productive operations:—

1. *Estimator*—who furnishes estimates of the cost to manufacture. To him requests for quotations are passed for preparation of cost upon which the quotation is finally prepared.
2. *Chief Draughtsman*—is in charge of the Drawing Office and is responsible for preparation of all drawings including preliminary and experimental detail drawings for manufacture and assembly. He may also be responsible for complete Parts Lists.
3. *Works Manager*—is usually in charge of the factory and may or may not also be in charge of all planning operations. The term is an elastic one, and is sometimes referred to as Works Superintendent, Factory Manager, Factory Superintendent.

4. *Works Engineer*—is in charge of the care and maintenance of the factory plant, power, lighting, buildings, etc. Usually he exercises close control over the Repairs and Maintenance Gang.
5. *Production Manager*—is often called the Production Engineer. He is in charge of the manufacturing operations and, as his name implies, his whole responsibility is Production.
6. *Planning Engineer*—is in charge of the planning operations and decides what work should be carried out in the factory and what should be obtained from outside sources.
7. *Operation Clerk*—breaks down the product into its various operations. He must have a comprehensive knowledge of all the machines and productive facilities within the organization.
8. *Rate Fixer*—attends to the rate values applied to each operation within the productive facilities of the factory on one hand and the rates and methods of payment within the factory on the other.
9. *Chaser*—checks up on the progress of the work, locates troubles and arranges for remedies.
10. *Progress Man*—is responsible for the recording of progress and all features associated with the production time table.

These positions are, of course, only indicative. Terms vary greatly in different establishments and whereas in one, the works manager may be supreme, in another he may be virtually a production engineer.

Planning Procedure.

As indicated above, the exact nature of production control procedure depends upon the type of industry involved and the kind of production operations carried out. In order to outline a typical procedure, however, a middle sized engineering shop, carrying out work to customer's specifications, is assumed. The following would be the sequence of operations:—

1. *Attend to the Customer's Inquiry.*

An inquiry is received from a customer asking for a quotation for the work detailed in the drawings and specifications forwarded. These would pass through the hands of the Sales Manager, or the Commercial Manager, and be routed to either the Production Engineering Department or the Quotation Clerk. In either case the details forwarded would be thoroughly examined, and a decision would first be made as to whether it is the type of work required by the organisation. If it could not all be carried out within the organisation, it may be necessary to refuse the job or to sub-contract a portion. If it is decided to quote, a thorough analysis of such factors as the following would be made:—

(a) Materials involved.
(b) Operations involved, including :—
    1. Departments,
    2. Machines,
    3. Labour.
(c) Availability of capacity.

The amount of detail involved would depend upon a number of factors. Usually it is a wise provision to see that if a quotation is being made, the work is carried out thoroughly. It is the practice of some concerns, however, to make the quotation on a rough estimate, particularly where the amount is small, or where the work is very well known, and has been carried out previously. When a quotation is available it is, of course, forwarded to the prospective customer.

2. *Attend to the Customer's Order.*

It is assumed that the quotation is successful and the order is received. The Sales Manager forwards it to the Production Engineering Department, after the usual routine of checking the order thus received with the quotation given. The procedure from this point depends upon the amount of detail which has already been accumulated in connection with the quotation. If this was insufficient for production planning purposes, the situation would be the same as if an order had been received for which no quotation had been given. Under those circumstances, the whole of the job would have to be closely examined.

3. *Make a thorough examination of all relevant factors.*

This would include obtaining answers to the following questions:—

1. What parts go to make up the product ?
2. Will all parts be made by the organization ?
3. If not, which parts will be thus made, and which are to be sub-contracted ?
4. Is it known to whom these will be sub-contracted ?
5. If not, what sub-contract procedure will be adopted ?
6. What materials will be involved in the manufacture ?
7. By whom will they be required and when ?
8. Which of these materials are in stock and can be appropriated to the job ?
9. Which must be purchased and how long before delivery can be obtained ?
10. What departments must process the work ?
11. What machines will be necessary in each department ?
12. What labour will be necessary ?
13. In what sequence must the operations be undertaken ?
14. Are there any special difficulties in arranging this sequence ?
15. Are there any bottle-necks ?

When this information is available, planning can proceed intelligently. This will involve:—

1. The preparation of all forms and records.
2. The purchasing of some materials and the appropriation of others.
3. The loading of work on machines.
4. Preparation of routing and scheduling cards.
5. The requirement of reports to show progress made.

These can now be considered in more detail.

1. *Material Requirements.*

A full list of these should be prepared. Any work to be sub-contracted may also be included. Where a special sub-contract section handles work of this kind, full details of the work required, together with any necessary specification and drawings, should be forwarded. Where there is no such section the information can be sent to the purchasing agent. The list of the remaining material can be treated in one of two ways—Firstly, it can be forwarded through to the purchasing agent, who should then inspect the materials records to find out what material is available, and what must be purchased. The lists of such materials should, wherever possible, include the dates by which delivery is required. The purchasing agent then appropriates materials in stock to that particular job by the necessary entries, through the Stores Ledger Cards, and, where necessary, advice to the Storekeeper. Those materials not in stock or not on order, should be purchased, by means of the purchase routine described in earlier chapters. Where it is impossible to match the delivery date requirements, immediate advice should be forwarded to the production planning department, as this may require a re-arrangement of all production schedules. The purchase routine should then be rigidly adhered to, including a close follow-up system and check upon deliveries made.

Secondly, this work can be carried out by the Production Control Department, which should have access to the various materials records, and a list of final requirements only need be handed to the purchasing agent who would carry out the purchase procedure and advise the Production Planning Department if the schedule of deliveries cannot be held.

Depending upon circumstances the Production Control Department may go further in the matter of materials. It may list a Bill of Materials for each department in triplicate. The first copy may be available for the particular department requiring the material, and would be forwarded to it, together with the production order and other documents. The second copy would be forwarded to the Storekeeper as an advice to him that these stores would be requisitioned by that particular department. At times, advice would be shown as to the materials which he would have in hand and the materials which would be purchased. The purchase order number may also be shown on the Bill of Materials, so that the Storekeeper receiving a copy would know from whom the goods purchased would be received. This enables him to keep a check upon the receipt of materials, particularly where they are urgently required. The third copy would be retained by the Production Control Department. When, ultimately, the Production Department affected presents its Bill of Materials, it would receive in exchange the materials listed thereon. Sometimes, however, it is not convenient to use a Bill of Materials for this purpose, and series of Stores Requisitions may therefore be attached to the Bill of Materials and the Requisitions can then be exchanged for the materials. This may simplify the procedure for the production section, because, without any difficulty, it can obtain just those materials it requires from time to time. It is often found advisable to have any further materials required in excess of the prepared requisitions or of the Bill of Materials, inserted upon special coloured requisitions and signed by someone in authority. This means, firstly, that immediate attention is drawn to the excess materials required; secondly, that urgent action may be necessary to obtain the materials; thirdly, that the sum of the coloured requisitions in relation to each particular job, represents the usage variance from the standard; fourthly, that the Cost Accountant can quickly summarise the variances by concentration upon the coloured requisitions.

In some organisations where deliveries of goods ordered are quite reliable, an order may be placed upon the Production Sections prior to the receipt of the materials, but scheduled in accordance with dates suggested by proposed delivery dates of materials. In other organisations, it has been found advisable not to load a job on the shop until such time as the materials are in stock.

2. *Analysing the Operations.*

After preparation of the material lists, the Production Control Department must make a thorough analysis of the parts to be made in relation to each and all of the operations involved in their manufacture. These will be divided firstly into the various departments affected; secondly, in relation to the machines in each department; thirdly, any factors involving special knowledge, labour, etc. Very often, it will be found advisable to seek the help and co-operation of the works manager and the departmental foremen. Indeed, collaboration of this kind is usually essential and desirable.

3. *Loading the Work.*

Bearing in mind the promised delivery date (if any) and the sequence of operations, the Production Control Department would take the various operations as analysed and route these through the shop from the first operation to the last. Dates may be set in relation to each operation, both for its commencement and completion. Thus, castings may be required from the Foundry, and these may then be forwarded to the Blacksmithing Department, through to the Machine Shop, thence to the Fitting, and later to the Assembly and finally to the Paint Shop. It would obviously be of no use loading the work on the Smith's Shop until after the castings have been completed and are ready to leave the Foundry. As a simple illustration, however, the following schedule could be planned.

FOUNDRY.

Commence Castings	Jan. 10th.	Complete	Jan. 17th.

Forward to Smith's Shop January 18th.

SMITH'S SHOP.

Receive Castings	Jan. 18th.	Commence Work	Jan. 19th.
Complete	Jan. 23rd.	Transfer to Machine Shop	Jan. 24th.

MACHINE SHOP.

Receive from Smith's Shop	Jan. 24th.	Commence Production	Jan. 29th.
Complete Production	Feb. 11th.	Forward to Fitters	Feb. 11th.

FITTERS.

Receive from Machine Shop	Feb. 11th.	Commence Work	Feb. 13th.
Complete	Feb. 14th.	Forward to Assembly	Feb. 14th.

ASSEMBLY.

Receive from Fitters	Feb. 14th.	Commence Work	Feb. 16th.
Complete	Feb. 22nd.	Forward to Paint Shop	Feb. 23rd.

PAINT SHOP.

Receive from Assembly	Feb. 23rd.	Commence Work	Feb. 26th.
Complete	Feb. 28th.	Forward to Despatch	Feb. 28th.

DESPATCH.

Receive from Paint Shop	Feb. 28th.	Forward to Customer	Feb. 28th.

Delivery Date Promised March 7th.

It will be seen from the foregoing that the schedule provided allows for some delay in each department, and also there is a week's grace at the end before the delivery date is upset.

Before the work can be scheduled, the job would have been analysed into component parts and the various operations in relation to each part specified. When this work has been accomplished there should be available in the production planning office a complete picture of what is required and what is to be accomplished. Furthermore, all the data should then be available to show how the work is to be carried out. This may well mean taking the various operations in relation to each part and deciding how the work is to be carried out—that is, what machines are to be used and what labour will be involved. It will be essential to know, therefore, when the machines will be available. It was explained above how the work would be scheduled as between departments, but it must also be scheduled within departments. Thus, one part may require treatment on several different machines within the one machine shop. It would be useless setting a time by which the work must leave the machine shop without ascertaining whether the production within the machine shop can be regulated in such a way that the several operations on the part can be accomplished not only in turn but in time. Thus, if some turning, grinding and drilling must be performed in that order, the machines for such must be available also in that order.

Where the production planning is carried out through the production control office, some arrangement must be made whereby it would be known in that office just what machine capacity is available from time to time. This is usually arranged by means of a machine loading ledger. The customary practice is to use Gantt Charts for this purpose. By this method, a chart divided into days and hours is used, and marked thereon are the commencement and finishing times of jobs which are loaded to each individual machine. A glance at the chart would therefore show:—

1. What work has been loaded on the machine.
2. When it will commence.
3. When it will finish.
4. What time is available for fresh jobs.
5. The earliest commencing and finishing date of any new work.

If the machine loading chart shows that the machine has been loaded to capacity already, the production planning office would know:—

1. That they cannot arrange for any more work until such time as present jobs are completed.
2. That if the work is urgent, some other job must be taken off the machine to make way for the urgent job.
3. The work must be carried out on some other machine.

In the case of decentralised planning, the loading on the machine is usually done by the foreman, either by some systematic method or rule of thumb.

Where the production office practises machine loading, it is obviously necessary to advise the machine shop just what has been planned. This can be done by a number of methods. For example, machine operation cards may be prepared for use in the machine shop. The procedure usually is to have a master card for each machine kept as part of the machine loading ledger in the production planning office. When the work is loaded on the machine, a machine operation card is made out and in due course is sent to the machine shop clerk who places it in a machine loading rack under the particular machine number. Usually, there are three apertures for each machine, Past, Current, Future. When the current operation on that machine is finished, the relevant operation card would be placed in Past and the operator of the machine will be handed the next card by the machine shop clerk. This card will give particulars of the work to be carried out, and it will either be kept by the operator while he is carrying out the work or will be placed in the Current aperture of the machine loading rack or Control Board as it may be called.

Inspection of the machine loading rack will readily show:—

1. Whether every machine has work ahead of it.
2. Which machines have no work.

The cards relating to jobs completed are collected, say, twice a day and forwarded to the production office, which would then proceed to record in the machine loading ledger that that particular operation had been completed. The graph would be marked so as to show the time of completion and the statistics shown in the machine loading chart would be amended as required. By prompt recording, the machine loading ledger should show the exact position in relation to each machine in the machine shop at any time.

Similarly, records are made of work leaving a department. If, for example, the work has been loaded on the machine shop to commence production on January 29, and to complete production on February 11, a comparison can be made to see how the work is progressing, once advice is received of the transfer of the work from the machine shop. This necessitates advice from the machine shop relating to the transfer and is usually accomplished by transfer card. This may be made out in duplicate, one copy going to the next department, and the other to the production office. This card would form the basis of the entry in the various schedule boards. Sometimes this information is recorded through the route sheets and advice is given to the production office by a separate record. The route sheet usually accompanies the work from the beginning to the end of its journey.

4. *Policing the Work.*

Where a schedule is not being adhered to, all subsequent operations may be affected. This may result in idle machines, idle operators and broken delivery dates, not only in relation to one product, but a number. Care should therefore be taken to see that everything possible is done to keep to the original time-table. This is the function of the Works Manager operating through the various shop foremen. Very often, however, because of the multitude of duties falling upon these individuals, the work is made the specific responsibility of a production chaser. This man acts as a kind of liaison officer between the production control office and the department, as, for example, the machine shop. He would receive advice on any jobs which were not keeping to the time-table, would ascertain the cause of the difficulty, would see if the work could be speeded up and may evolve alternative methods of getting the work done quickly, in order to catch up time lost. This work may become especially important where a part has been spoiled and it becomes necessary to make a new part to take its place. This new part may have to catch up all the operations quickly, so that it can take its place upon the assembly bench at the time it is required.

In addition to functions of this kind, it may also be the responsibility of the production chaser to see that completed work is shifted quickly from one machine to another or from one department to the next. It often happens that the actual operations performed are carried out within the time-table, but because the transport section does not carry out its job efficiently, work which should be moved on is left at the scene of the previous operation. In addition there are a number of other troubles to which a production chaser can turn his attention. Even where care has been taken to see that the requisite materials are available, one material can form a bottle neck when it is actually required. The production chaser may be called upon to locate the cause and suggest a remedy.

5. *Inspecting the Product.*

Inspection is a most important function within the productive organisation and can take a number of forms. This subject is, however, dealt with separately in Chapter 40.

Product Analysis.

The following questions will arise in the case of product analysis:—

1. What parts are to be made in the works and what should be subcontracted ?
2. What quantity and what types and grades of material will be required for each part ?
3. What parts are included in sub-assemblies and how many of such are used in the final assembly ?
4. What manufacturing processes are to be used and in what sequence ?
5. What time should be allowed for each operation and what setting-up time ?
6. What toolage will be required and how is it to be obtained ?

Planning Routine.

The steps to be taken in planning and producing a job in an engineering establishment can therefore be summarised as under:—

1. Planning office receives copy of order from sales department.
2. Various copies are made of the order and distributed to interested sections.
3. Draughtsmen commence to work upon all necessary drawings, including working drawings.
4. Production clerk lists bills of material as drawings are received.
5. Bills of material sent to purchasing department.
6. Purchasing department orders materials in short supply.
7. Bills of material are forwarded to stores when all materials are available.
8. Preliminary advice regarding the work may be sent to all interested sections.
9. All necessary operations are decided upon.
10. Toolage is determined.
11. Quality standards are ascertained.
12. Operation methods are laid down.
13. Operation times are set.
14. Operation sequency and routing determined.
15. Equipment and machine capacity investigated.
16. Production sequence laid down.
17. Labour requirements investigated.
18. Master control cards prepared for office records.
19. Operation control cards prepared for departmental use.
20. Route sheets with timetables prepared.
21. Machine loading ledger entered.
22. Dates assigned to route sheets.
23. Priorities determined.
24. Production orders released, together with operating orders, drawings, specifications and instructions.
25. Reports received from departments.
26. Operating orders and production orders received and progress records checked.
27. Inter-departmental stock transfers arranged.
28. Delivery records posted.

This sequence of operations may vary considerably in different factories, but is typical of a normal approach. (See Figure No. 120).

FIGURE No. 120.

PRODUCTION OFFICE ROUTINE CHART

PRODUCTION OFFICE DATA.

A. Desk 4. **Analyse job, set operations, prepare Tool List, and instructions. Prepare Route Sheet, supervise preparation of Works Orders.**

B. Desk 2. **Dates assigned to operations shown on Route Sheet, Machine Loading Chart, and Machine Loading Ledger posted.**

C. Desk 2. **Set Machine Schedule Board weekly, signals progress, idleness, etc., daily and releases operation orders to coincide with Machine Schedule Board changes.**

D Desk 6. **Operation Orders** prepared from data on Route Sheet.

E. Desk 2. **Operation Orders** released weekly to coincide with weekly posting of **Machine Schedule Board.**

F Desk 3. Prepare **Progress Charts** from data on Route Sheets.

G Desk 3 Post all **Progress Records** and **Delivery Records.**

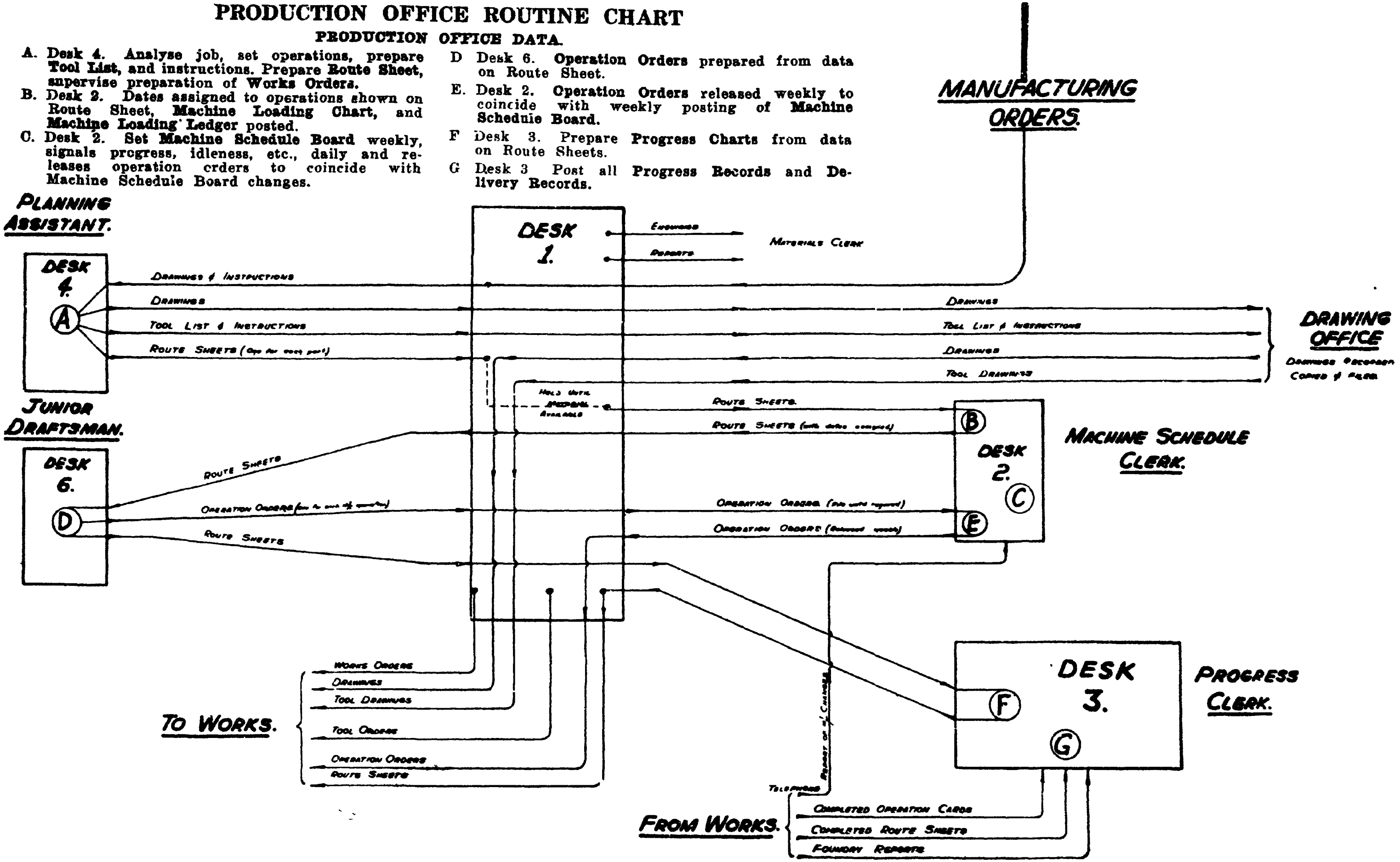


FIGURE No. 121.

MACHINE LOADING CONTROL.

Type of Machine.................... Location ....
No. of Machines..................... Department...........................
Total Weekly Hours 960 Foreman.............................
Less Maintenance 60

Available Weekly Hours 900 hours Month of February.

		WEEK ENDED							
		7th		14th		21st		28th	
Order No.	Operation No.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.
1246	4			260		300		100	
1248	5			120				250	
1256	22	100	120					300	
1300	6	150	160	100		180			
1301	1			400		200		100	
1306	3					100			
		250	280	880		780		750	

FIGURE No. 122.

MACHINE LOADING LEDGER.

Machine No........................... Location ....

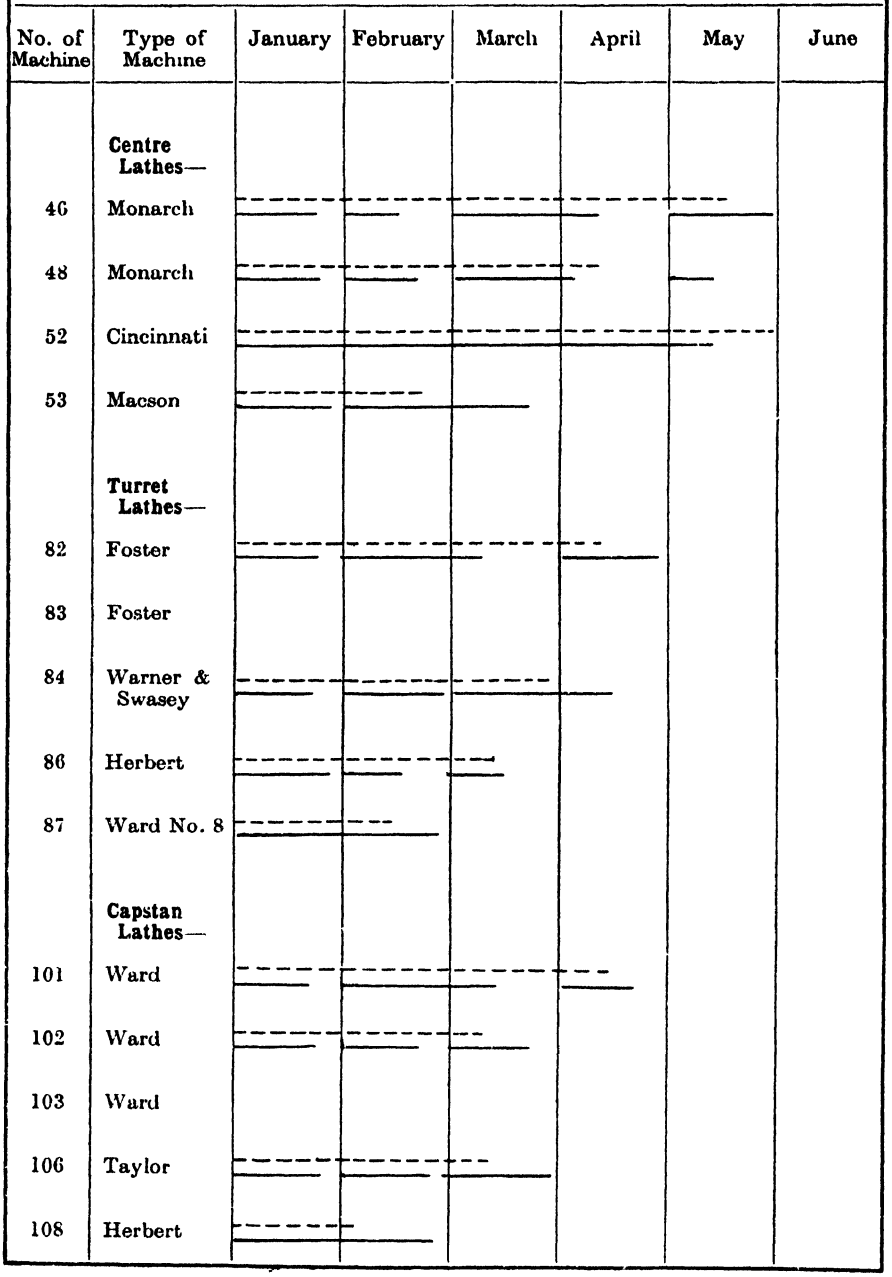
Type ....

Order No.	Part No.	Component No.	Estimated Time	Actual Time	Balance of Load	Diff. between Estim. & Actual	Remarks
					86.0		
125	A46	A46/2	4.30		90.30		
126	324/C	245/C/1	6.15		96.45		
132	A63	A63/4	2.30		99.15		
125				5.0	94.45	.30	
126				6.0	88.30	.15	

FIGURE No. 123.

GANTT MACHINE LOADING CHART.

LATHES.



Machine Loading.

If control is to be exercised in relation to planning, it is essential to see:—

1. That machines are used to maximum capacity.
2. That machines are not overloaded in such a way as to minimise the chance of keeping to the schedule set.

The ideal is to keep each machine in the shop working to capacity, yet planned in such a way that all jobs flow through in required fashion. This ideal is much easier to accomplish in some industries than in others and definitely so in the case of some machines than others. In process work for example, it may be a simple job to keep machines running constantly. With special job order work, however it may be an extremely difficult matter.

Machine loading is usually carried out on a time basis, though it can be measured in terms of units. Thus a machine may have an output of a certain quantity of tons, gallons, yards, super feet, etc., per hour. This yardstick is usually of value in machines in the process industries as for example—a furnace, a hopper, a sewing machine, a breaking down saw.

With machine shop operations, machine loading is almost invariably carried out by the allotment of times to certain jobs and the building up of total times thus allotted. An allowance must at all times be made for "setting up" times as these reduce the time available for actually carrying out the operations.

If it is found that machines are overloaded, one of three methods may be adopted to overcome the difficulty:—

1. Work may be diverted to other machines.
2. Overtime may be worked.
3. The priority of work may be altered to allow more acceptable scheduling.

Usually control over machines in respect to loading is carried out either by Gantt charts or by a machine loading ledger. (See Figures Nos. 121, 122 and 123.) Some comprehensive charts are arranged in such a way that they show at a glance the exact position in relation to every machine in the shop, in regard to:—

1. The total hours the machine can be worked.
2. The total amount of work loaded on to the machine.
3. The dates upon which such work must be carried out.
4. What time is still available for loading further work.
5. When such work could be commenced.
6. How actual times loaded compare with actual times taken.

CHAPTER 38.

PRODUCTION CONTROL.

Planning is but the preliminary to actual processing. When the planning has been completed the work can be placed "on the shop" and it is then the function of works management to see that production is carried out in accordance with the plans prepared. During the actual production therefore constant attention should be given to the various factors which can upset the planned schedule.

In order to control production adequately, answers to the following questions must constantly be known:—

1. Is the actual output in line with that schedule ? (See Figure No. 124).
2. What are the causes of delays ?
    (a) Material shortage ?
    (b) Labour shortage ?
    (c) Plant shortage ?
    (d) Toolage shortage ?
    (e) Breakdowns ?
3. Is quantity of work in progress to schedule ?
4. Is quality of work in progress to schedule ?
5. What quantity of material has been scrapped ?
6. What quantity of material must be re-processed ?
7. What quantity of new material is required ?
8. Are the operations being carried out as planned ?
9. Is the operation sequence as planned ? (See Figure No. 125).
10. Are operation times being carried out on schedule ?

Obviously, a large number of other questions may arise, particularly in special cases.

(a) *Routing.*

The routing process is usually carried out by use of Route Sheets, which generally include the following information:—

1. Number, including symbol covering the order.
2. Part No., together with drawings, blueprints, etc.
3. Number of pieces to be made.
4. Full information re—
    Schedule of operations.
    Machines to be used.
    Sequence of operations.
    Special instructions.
    Time allowed for each operation.
    Date of completion.

The route sheets usually accompany the job through the shop, and as all the entries are entered, they become a valuable history of the job and provide a ready method of checking what has happened from the first operation to the last. (See Figures Nos. 126, 127 and 128.)

FIGURE No. 124.

COMPONENTS DELIVERY SCHEDULE.

June, 1944.

Assembly No.	Part No.	Component No.	Number Required by													
			2	5	7	9	12	14	16	19	21	23	26	28	30	
A50	214/6	214/6A	20	20	20	20	20	20	20	20	20	20	20	20	20	
”	216/2	216/2A	100			50			30			100			50	
”	A43/1	A43/1C	50	50	50											
”	220/2A	220AC	30	30	30	10	10	10								
”	128/1F										60					

FIGURE No. 125.

PRODUCTION CONTROL SEQUENCE.

		Order Dept.	Designing Dept.	Production Planning Dept.	Purchasing Agent	Stores Dept.	Production Dept.	Inspection Dept.	Costing Section	Despatch
1	Order received	1								
2	Completion Date Specified	2								
3	Making New Designs		3							
4	,, Drawing Lists		4							
5	,, New Drawings		5							
6	Preparing Bill of Materials			6						
7	Stores Record Checked			7						
8	Materials Request to Purchase			8						
9	Purchases Made				9					
10	Materials Received					10				
11	Detailed Shop Orders Prepared			11						
12	Routing & Instruction Card Prepared			12						
13	Tool Lists			13						
14	Operation Times			14						
15	Scheduling of Work			15						
16	Productive Work						16			
17	Despatching & Controlling Work			17						
18	Inspection							18		
19	Timekeeping & Costing								19	
20	Despatch & Delivery									20

Sometimes operation sheets are referred to as route sheets, but usually they are kept separate. Route sheets should never be altered by anyone except the planning office which was originally responsible for their preparation. If any change in any operation is to be made, or a different time set, obviously all other associated records will be upset unless the alterations are known to the planning office. When the alterations are made, the revised route sheets should be exchanged for those initially prepared and this should be done thoroughly to prevent any possible duplication and also to see that the operations carried out are in line with the new route sheets.

Where there are sub-assemblies and assemblies involved, all route sheets relating to such must be grouped together so that scheduling will be arranged to permit all the parts being ready when the assembling operations begin.

FIGURE No. 126.

ROUTE CARD.

Production Order No.....................

Prepared by .... Part No............................
Checked by....................... Part Name.........................
Date............................... Drawing No......................
Material .... Batch ....

Operation No.	Description of Operation	Machine No.	Grade of Labour	Setting Up Time	Jigs and Fixtures	Tools	Time Allowed	Total Time

FIGURE No. 127.
ROUTE SHEET.

Date................................
Part No............................
Component No..................
Specification No. ....

Production Order No..........
Drawing No.....................
Pattern No. ....

	Commenced	Completed	Moved	From Dept. No.	To Dept. No.
Drawing					
Pattern					
Material					
Foundry Casting					
Grinding					
Planing					
Drilling					
Etc.					

FIGURE No. 128.
ROUTE SHEET.

Part No............................
Component No..................
Quantity Required..............

Date................................
Production Order No..........
Prepared by ....

Operation No.	Operation	Quantity	Finished	Employee Clock No.
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Dispatching.

A definition of this function has already been given. Actually it includes the following functions:—

1. The movement of materials throughout—from store to first operation, to each subsequent operation and finally to store as finished stock. (See Figure No. 129).
2. Issue to the tool store of requisitions for necessary tools, or to the tool department for the manufacture of any special tools, etc. (See Figure No. 133).
3. Issue of production order, or shop orders, together with operation and time cards, authorising production.
4. Entries necessary to record progress of the job, including all entries covering machine loading charts, route sheets, schedule boards, etc.
5. Issue of all necessary inspection orders.
6. Issue of all "chaser" or "rush" or special orders. (See Figure No. 130).
7. Records relating to the commencement and delivery dates of all jobs.
8. The recording of all idle time of operators and machines, and the reasons for such

FIGURE No. 129.

MOVE ORDER.

MOVE.

Date................................
Order No. .... Workman ....

Description of Part	Lot No.	From Department	To Department	Remarks

Work Completed.................................. Date..............

FIGURE No. 130.

RUSH ORDER.

RUSH.

(To take precedence over all General Orders.)

Production Order No..........

Date................................	No. of Pieces.....................
Required for Order No..........	Part No...........................
Material	Component No..................
Commence	Specification No. ....
Complete by	Drawing No. ....
Authorised by....................	Pattern No. ....

DEPARTMENTS
Complete by

Blacksmithing ....
Machining.......................
Assembly ....

Deliver to ....

Inspected by ....

Foundry Procedure.

The following procedure is taken from "Industrial Management" by Anderson, Mandeville and Anderson (Ronald Press Co.) and is a representative procedure, arising out of partly centralised planning:—

20. When castings are required, the following data sheets and forms are prepared and sent to the foundry, and constitute an order for castings.

Bill of Material Sheet and for each item of castings:

1 master time card (AP32)

is typed in hectograph ink and used to make the following:

4 time cards	(100232 cut)
1 duplicate time card	(DF32A)
1 stores issue	(19765)
1 route tag	(DM6)

Upon each of the cards appears a description of the castings required, date to be delivered to the machine shop and other information.

With these data and information the foundry office is expected to produce the castings wanted at the time designed without any further direction. In other words, the foundry handles the details of department control from its own office.

21. Upon receipt of the above order for castings the foundry office orders the necessary patterns from the pattern department, and these are made available. Pattern numbers are supplied on the bill of material sheet.

22. Upon the time cards is stamped the following information:

Date of receipt
Kind of iron in castings
Size of core.

23. Then the foundry office sends direct to the foundry cleaning room:

2 time cards
1 stores issue

where the time cards are filed according to date received in a drawer corresponding to the class of order it is in, and the stores issue is filed by order number.

24. When the pattern is made available on the " bench " there are attached to it:

2 time cards
1 duplicate time card
1 route tag.

25. If a core is required the core maker gets one time card; otherwise it is destroyed.

26. When the molder takes the pattern, he takes a time card, and drops the duplicate and route tag in a box which indicates that the work is in operation; which fact is recorded by a mark opposite the item number on the bill of material in the foundry office.

27. The route tag and duplicate time card are then taken to the cleaning room, and attached to the time card previously sent there which indicates that the castings are coming through.

28. The molder turns in his time card marked " finished " when he completes the task. If he does not finish the job the same day it is started, the time worked is stamped on the back of the card, and it is reissued to him the following day. As soon as he completes the task, the foundry clerk so indicates by another mark on his bill of material sheet opposite the item number.

29. The actual castings will soon appear at the cleaning end of the foundry. The clerk in this department then issues to the chipper and grinder the following forms:

2 time cards (if two men work on castings)
1 route tag
1 duplicate time card.

As soon as the finishing touches are put to the castings by these men in this department, they are ready for final disposition by the foundry.

30. They are weighed and the weight put on the duplicate time card. The stores issue card is taken from the file and the weight entered thereon.

31. The duplicate time card is sent to the production clerk in the planning room as an indication to him that the castings have been made, and he so indicates by a mark on the order sheet opposite the item.

32. Foundry production is kept track of by daily reports. On the sheet used are spaces for a record of the different kinds of castings produced, and for each kind,

columns in which to note the order number, item number, number of pieces and weight of each lot. The column totals and grand total give the production figures for the day.

33. In the melting department of the foundry a record is kept of the raw materials which go into the making of the castings. Comparison of these two records gives a check on daily operating efficiency, metal losses and waste.

34. From the stores issue cards a list of all castings is made each day as they go through, and this list is delivered to the planning room for the benefit of the schedule clerk.

35. The stores issue card is given to the rough stock man and accompanies the castings, to which are attached the route tag, to the receiving station in the machine shop. The clerk in charge receipts for them, sends the stores issue card to the dispatch clerk in the planning room, and the castings to the point where operation number one will be performed upon them.

36. Receipt of the stores issue card by the dispatch clerk is a signal that machine shop operations may now be started.

Machine Shop Procedure.

37. For any item on the bill of material sheet which does not originate as a casting in the foundry, the following forms are made.

1 master time card	(AP32)

is typed in hectograph ink and used to make the following:

1 route tag	(DM6)
1 stores issue card	(19765)
2 transfer slips	(AP49)

and for each operation

1 time card	(100232 Perf)
1 duplicate time card (*)	(DM47).

* Duplicate time cards are used for posting on the planning board in the planning room while the job is being done in the shop. For short jobs they are not used.

38. After the necessary cards and forms are made out the route sheet is filed at the schedule clerk's desk, where a record of the progress of work is kept.

39. All time cards, together with shop copy and move cards, go to the rate clerk to be rated. This consists in posting on the time card data in regard to pay, and indicating the instruction card and any necessary drawings which need to be issued.

40. When ready for work to begin on the item, the dispatch clerk sends the stores issue card and route tag to the stores department, which issues the proper material to the shop. Upon notification that this has been done, the dispatch clerk may issue the job ticket (time card), for the first operation.

41. The cards for all operations on the item are bunched and placed in the compartment of the planning board which designates the machine used for the first operation. The duplicate time card for the first operation is placed in the front division of the box and the other tickets back of it. The arrangement or order of job card groups constitutes the order of work or manufacturing schedule decided upon. For each machine or work station there are provided two compartments in the dispatch box as indicated. The cards in one compartment represent jobs on that machine arranged in the sequence in which they are to be performed. The duplicate time card in the front compartment represents the job the man is working on. Cards in the rear compartment represent jobs at the machine, but the sequence in which the jobs are to be performed has not been determined. The order of jobs is regulated by the schedule clerk in accordance with the shipping dates set for the various jobs, and the necessary time for completion of parts; information obtained from the shipping board and manufacturing schedules in the planning room. Also he must endeavor to keep all machines and work stations uniformly busy.

42. The workman as he receives the time card also secures an instruction card and drawings, if such are designated. Any special tools required are also drawn. When the time card is issued the time is stamped by a time clock. When the job is completed and the card turned in, it is again stamped, and the time interval is the job time.

43. The transfer of material in work from one machine to another is accomplished by the move men by referring to the route tag attached to the material. The mechanic completing an operation takes and places the material ready for the move man who attends to its moving without any further instruction; or his attention may be called to it. At an inspection point, or when removed from one department to another or into stock, signatures are required, and transfer slips are utilized.

44. The completion of one operation is a signal to the dispatch clerk that the labour ticket for the next operation may be issued. As each operation is completed the order of work clerk turns to the route sheet and draws a blue line through the numbers referring to it, and marks the date. When all are so marked the date of final inspection is stamped upon it.

45. Daily, all route sheets on which all items have been completed and inspected are taken from the files and sent to the superintendent, and a notification of these jobs and sheet numbers is sent to the production clerk for his information.' (See Pages 566/572.)

Production Control for Textiles.

The foregoing description is designed to indicate in broad terms the method of approach in planning and controlling the productive operations in an engineering establishment. Whilst there are certain fundamental principles in all production planning and control, the precise methods adopted and the procedure to operate may vary greatly between industries. The foregoing methods can, for example, be contrasted with those which would operate in a textile mill, such as, for example, one which purchases yarn, knits it into fabric, and then turns the fabric into garments. In such a case, the procedure would probably be similar to that described hereunder.

A decision would be made as to what garments are to be manufactured during a specified period. Where one type of garment was being manufactured, and production was to be kept at the full capacity of the plant, little planning would be necessary. Where, however, a variety of garments were to be made, and seasonal factors would have to be taken into account, undoubtedly the most efficient method of control commences with the Production Budget. Even this may originate from a Sales Budget, which would be translated into production quantities and grades of products.

When the Production Budget is available, it should be examined in terms of grades and sizes, as these must be given full weight in any production programme. The first step would be to take the various garments noting the styles, and interpreting these in relation to the fabric which would be required. The fabric would then be analysed into knitting production and through this series of steps a knitting programme budget would finally be drawn up. It should be noted that if the production budget was prepared in terms of finished production from, say, 1st January to 30th June, it may be necessary to commence the knitting programme for the production of the fabric from which the garments could be cut by, say, 1st December. This would give the knitting department sufficient time to knit fabric which could be forwarded to the cutting department, by, say, 20th December, and through to the machining and finishing departments by the end of December. This would mean that the finished garments would commence to flow into the warehouse in support of the budget figures by the 1st January.

If, on the other hand, the budget was prepared in terms of the knitting department from 1st January to 30th June, the commencement of the knitting programme covered by the budget figures would be from the 1st January. Irrespective of what method is applied, it is fundamental to see that there is a co-ordination between the various departments. Where there is a succession of departments, each depending upon the preceding one, the avoidance and elimination of bottlenecks is one of the most important considerations in planning production.

FIGURE No. 131.

PRODUCTION CONTROL—COUPON SYSTEM.

PRODUCTION ORDER No.........

Serial No. 100........................... Product ....

Style................. Size............... Quantity.............. Colour...............

Issued to Cutting ....

Firsts ....

Machining........................

Seconds ....

Finishing ....

Others ....

Warehouse........................

Warehouse			Rep. Check
Checker			Rep. Seconds
Stamp			Rep. 1st Mends
Box			Buttonhole
Parcel			Plain Sew
Transfers			Buttonhole Mark
Stickers			Machine Dept.
Press			Cutting
Seam and Fold			Lay
Trim			Fabric

A typical production control system in a textile factory would involve the purchase of yarn in sufficient quantities to see that the productive operations of the knitting department were not interfered with by shortage of yarn. When it was proposed to commence the knitting production in that department, a production order authorising the knitting of a certain amount of fabric, with full particulars in relation to such outlined, would be prepared, and this would be the authority for the knitting department to proceed with the work. Usually this work would be timed to finish by a particular date, and arrangements would be made, firstly, to check the quantity and quality of production, secondly, to complete the record showing what had been produced (particularly where a bonus scheme for operators is in existence), and transfer the fabric to its next department. Ultimately, it would find its way to the cutting department store, which would give a receipt for it, possibly on the production order which was originally responsible for its being knitted in the knitting department.

The fabric store would obviously hold all the fabric required for the cutting department, and when the cutting department supervisor decided to commence production on some of the garments mentioned in the budget, a production order authorising such should be prepared. In the case of work of this type, usually a coupon system is the most favoured, and the production order would therefore outline the whole of the operations to be carried out in the manufacture of the garments specified in such order. As each operation was completed, the descriptive coupons would be detached and these would be used for calculation of bonuses, where a bonus system is in operation. (See Figure No. 131.)

Very often the production orders are standardised to show all the operations which could be carried out in connection with any groups of garments. If in any particular case all these operations would not be carried out, the appropriate coupons would be left attached to the production order. Such production order usually accompanies the product from the time it is bundled after cutting until it finally emerges as the finished product. Each departmental supervisor can check the position in the department by inspection of the production orders uncompleted.

By careful recording of the production completed under each production order in each department, viz., knitting, cutting, machining and finishing, the exact stage reached by production throughout the plant is known. Usually this production is measured against a budget, as this is one of the best methods of seeing that production is satisfactory. Furthermore, an analysis of the departmental statistics will show whether any department is lagging and whether there are consequently any bottlenecks.

Classes of Industry.

It should be readily understood that this type of production control is totally different from that experienced in an engineering shop. Obviously, this is due to the different type of operation involved. It is therefore largely true to say that the type of industry and manufacturing is the biggest single factor affecting the general type of control that may be employed. Though it is not possible to specify certain classes of industry into which any organisation may readily be fitted, it is probably true to say that industry generally conforms to the following:—

Type of Industry.	*Type of Manufacturing.*	*Type of Control.*
Assembly Industries.	Intermittent	Order Control
	Continuous	Flow Control
Semi-process Industries	Intermittent	Block or order control
Process Industries		
Mechanical Process	Intermittent	Block or order control
	Continuous	Flow control
Chemical Process	Intermittent	Block or order control
	Continuous	Flow control.

In the case of an assembly industry, components are either manufactured or purchased and parts are built up from these. Assemblies or sub-assemblies with ultimate assemblies, are usually carried out as the final operations. The manufacture of a machine is a case in point. This may require components into parts, parts in minor sub-assemblies, minor sub-assemblies into major sub-assemblies and these into the final machine.

A process industry is of a totally different type, and the problems are quite different. Rolling mills are examples of this type. In a brass rolling mill, for example, the brass may come from the foundry in slabs which would then be passed through roughing mills, making it thinner, longer and somewhat wider. The elongated slab is broken down again by successive mills until it reaches the finishing mills. Here it is turned out to the exact gauge required.

Half-way between these two types are certain industries which share the characteristics of both. Printing and textile concerns come within this category. They adopt both process and assembly type of operation.

The types of manufacturing may also be considered as being either continuous or intermittent. The former may be defined as that type of industry in which machines and labour are continuously applied to the product for an extended period of time. Here planning must take into account the procurement of materials and the setting up of tools and machines to produce and supply continuously a large quantity of parts or products to the store room or the assembly floor for a considerable time. One machine may be retained on one part almost throughout the year. Factors usually associated with continuous manufacturing are standardisation and volume of production.

On the other hand, in the case of an intermittent assembly industry, the basis for the division of operative responsibility is the classification and grouping of operative functions on the basis of the kinds and types of equipment required. Because the volume of production is much smaller, control has to be extended to each order or each batch of products. Furthermore, materials are usually transported greater distances.

Continuous manufacturing is as a rule more economical, but less flexible than intermittent manufacturing. Usually as a business grows it tends to develop a higher degree of operating continuity and this usually has an effect upon the type of control that can be used.

Classes of Control.

There are two main types of production control—order control and flow control. The former is concerned with controlling the successive operations and departments and making sure that each order arrives and leaves the department or cost centre at the proper time so that all operations can be kept within a specified delivery schedule. Machine capacity of the right kind must be available and tools, jigs, fixtures and materials must be available. Furthermore, the control methods must be such as to ensure that a speedy check can be made of progress achieved at any time.

On the other hand, flow control methods are based upon the maintenance of a pre-determined rate of flow of work from each machine or work centre. This usually involves, at the outset, careful check to see that machine capacity in relation to each operation is correctly balanced. Very often much more accurate knowledge is available at the outset upon which planning can be based.

Briefly, the difference between these two types of control is that the first has to plan operations in such a way that each will correctly dovetail into the other. The latter lays down a departmental delivery schedule and constant check is exercised to see that the flow is in keeping with this.

Alternative Classification of Industry.

The different types of industry may be specified in somewhat different fashion, as, for example:—

1. *Manufacturing to Order.*

This is specialised work where every job may be different. It may involve making a single article, making a limited number, or making a very large number of pieces. The fundamental consideration is that each requires not only special and careful planning, but must have individual attention. Usually no work can be started in the shops until a sales order has been received and analysed. Sometimes stock orders are handled as well, but this is usually not so. There is usually difficult work in assigning specific jobs systematically to individuals, machines or production centres. In this type of industry, the ultimate efficiency characterising the work depends primarily and chiefly upon the care exercised in the initial planning. This is usually the most difficult type of production control and requires skilful direction.

2. *Continuous Process Industries.*

These are usually comparatively easy to plan and often it is necessary only to see that full stocks of essential raw materials are continuously available for processing. In a sawmill, for example, as long as there is a sufficient supply of logs and providing there is no breakdown in operations through machine or steam trouble, the sawn timber should flow from the mill continuously. A similar condition would be experienced in connection with a flour mill. The output is usually reckoned in terms of periods—per day, per week, per month.

Of a similar type are those industries which adopt mass production methods. Where parts are being continuously turned out for assembly, the planning process in relation to such parts may be simple. Care may have to be exercised, however, in relation to the sub-assemblies and the final assemblies. Characteristic of this process, is the relatively long period of time during which equipment is tied up on continuous runs. Here there is evidence of the flow nature of production, everything being constantly on the move. Materials flow into the plan, in accordance with rate schedules, and flow through the productive departments and assemblies into delivery yards.

3. *Manufacturing for Stock.*

This type of industry may have some of the characteristics of mass production in a limited way, and some of those of special job order. Usually the product is already in a specified quantity and when completed is kept in store and sold ex store to customers. Very often in such cases, there may be a break between manufacture of the parts and the final assembly of the product. This may necessitate entirely separate planning dates and procedure.

Of similar type is that work carried out by commercial printers, looms, forming presses, etc., which, whilst not necessarily for special order, yet cannot be classed as mass production. Largely this is a problem of loading against available equipment, and careful attention must be paid to the amount of time required for each job assigned so that some means may be provided of ascertaining when any new order may be promised, or when work must be sub-let because of orders exceeding productive capacity.

Control Boards.

Actual control is usually exercised through:—

1. Control Boards.
2. Statistical Charts.
3. Gantt Charts.
4. Designed Forms.

In each case it is necessary to see that the statistical information flows through from the factory so that control can be effectively undertaken.

In the classification of industry outlined above, the physical expression of control would probably take different forms.

In the case of Manufacturing to Order, control would probably be exercised through a Board upon which the number of each machine may be entered. Against such number, there would be three pockets—one each for "Jobs Completed," "Current Jobs," "Next Jobs." Sometimes four pockets are used, "This Job," "Next Job," "Jobs Ready" and "Jobs Waiting." This was explained on pages 516-517. Actually this information may be shown on a Control Board in a central planning office. Very often it would be summarized in the form of Gantt Charts.

With Continuous Process Industries, Control Boards usually consist of a series of Statistical or Gantt Charts which set forth the progressive results relating to each process or department. Sometimes both the budgeted and the actual results appear on these Boards. At times specially prepared forms are used to record the information.

With Manufacturing for Stock, it may be necessary to have Control Boards both to control Raw Materials and sub and minor assemblies, and also completed products. Where there are large numbers of assemblies, the timing of production may be of the greatest importance to see that operations interlock. The Raw Materials Control Board would list the various materials required, the quantities necessary and the dates by which they should be available. The Assembly Control Board may list the various sub assemblies, the quantities required and when they should be available.

Control Boards usually rely upon the potency of visual display. They are usually designed to show at a glance and at a centralized point the latest production position. Weaknesses can thus be quickly detected and remedies applied. The type of Board used may differ in almost every organization. Many conform to similar principles but the methods of displaying the information are exceeding numerous. The guiding rule is to see that the Control Board sets forth the fundamental factors necessary to facilitate control in as simple but as effective a manner as possible.

Results of Production Planning and Control.

A summary can now be made of the results which can be expected from a suitable and adequate system of production planning and control.

1. Material stocks may be reduced.
2. Finished stocks may be more balanced.
3. Work in process may be kept at a lower figure.
4. Plant, equipment, facilities and space may be more fully and beneficially used.
5. The investment in tools, jigs and fixtures may be reduced.
6. Labour production standards may be improved.
7. Total costs may be reduced, through savings in materials, labour and expense.
8. Delivery promises may be kept.
9. Sales quotas may be maintained.
10. Over-production may be avoided.
11. Executive control may be assisted by concentration upon exceptions.
12. Factory supervision may be simplified.

Co-operation by the Cost Accountant.

Chapter 37 began with a statement that the cost accountant should have some knowledge of the principles of production control. Only by such can the cost accountant play his part in increasing co-operation between his section and production. It should be remembered that the paths of each frequently cross. There are many records which are used by both sections, and collaboration between the two will help to eliminate duplication. A little expansion on the part of the record used by one section, may make it quite suitable for use by the other and an extra record may be eliminated.

Where standard costs have been established production control is of the greatest assistance to the cost accountant in the attainment of these standards, firstly, by using them and then by exercising the maximum control in endeavouring to achieve such standard figures. Indeed it may be said that standard costs represent the plan endorsed by the cost accountant and the production department endeavours to carry it out. Furthermore, the assistance of the production department is invaluable in measuring variations and discrepancies between standard and actual costs and frequently it is in the best position to point out any errors in the standards.

Even where there are no standard costs, it is essential to secure the co-operation of the production planning and control staffs, as the cost accountant will be largely dependent upon them, not only for records in connection with his costs, but also for basic data which will be of the very greatest assistance in the preparation of managerial and executive statements. Indeed, in relation to this portion of his work, it may be virtually impossible for the cost accountant to carry out his work in the best way without the assistance of production sections. Any time spent in learning the productive routine and operation, in trying to understand the problems of the production department, in learning at least in general fashion its methods and procedures, will surely result in the cost accountant becoming a better executive in relation to his own work.

CHAPTER 39.

TOOL STORAGE AND CONTROL.

In many organisations the cost of toolage is a most important item and can reach high figures. Care exercised in connection with toolage can at times effect large economies and the work of the cost accountant may well bring him into touch with this aspect of the work.

Tools usually include jigs, dies, templates, fixtures and other necessary equipment used to effect some changes in form.

Responsibility for and Location of Toolroom.

Upon the Tool Department rests responsibility for:—

1. Having the proper tools available when needed.
2. The requisite procedure for issuing and receiving tools.
3. Proper storage of tools.
4. Repairs and maintenance of tools.
5. Records and inventories of tools.

The location and number of toolrooms is usually determined by:—

1. The character of service required.
2. The convenience to the workmen.
3. The cost of administration.
4. The varying requirements of departments.

Principles of Toolage Control.

These may be described as follows:—

1. *Control.*

The system of tool control should be designed having in mind the particular circumstances operating in the particular plant.

A system which will work admirably in one plant is useless in another. Indeed different treatment may be necessary even with different departments in the same plant. The fundamental requirement of any tool control system is to see that it provides prompt and adequate tool service to the whole of the factory. In some cases, the men may provide all the tools they require, in others they may themselves provide a standard kit of tools and the organisation provide anything outside such kit. Again, the organisation may provide all tools, either by means of a standard kit to each workman or by requisition from each workman in relation to the tools he needs. (See Figure No. 132.)

2. *Maintenance of Toolroom.*

There are many advantages associated with the maintenance of a good toolroom. Usually it will be found that this is the only way of ensuring adequate control over the value of the asset. Equally important, however, is the fact that unless there is a toolroom there is almost certain to be dislocation and confusion. Considerable care should be given to the layout of the toolroom and the method of storing the tools, and it will frequently be found that the toolroom is best situated centrally, though each case demands individual treatment. Generally the tool crib, where the tools are stored, is kept separate from, but connected with, that portion of the toolroom where the tools are made.

FIGURE No. 132.

TOOL KIT.

Machine .... Department ....
Date Issued......................... Check Each ....
Signed ....

Description	Symbol	Value	Replacement					Remarks

FIGURE No. 133.

TOOL REQUISITION FORM.

Please supply to Dept...............................the following jig ,
tool ,
to be used on Order No. , Operation No ,
Machine No.

This is to replace

The advantages are :
Cost :
Quality :
Cost of item will be
Will be used times per on lots of
Age of present tool : Tool No. Cost :
Sketch here (or attach sketch)

Date : Works Manager :

Many of the considerations which should be taken into account in the setting up of stores must be taken into account also with toolrooms.

3. *Personnel.*

The toolroom personnel should be carefully selected. The work in the toolroom is responsible work. In the manufacture of tools very often the highest degree of accuracy is necessary and the man in charge is often a very highly skilled engineer. Again, no definite rule can be laid down but each case should be examined. He may well need to be highly skilled because of the demands that will be made upon him, not only in relation to the making of tools, but also in relation to general questions regarding gauges, worn or damaged tools, inspection of tools and machines. In relation to the tool crib, there is also very often a great deal of responsibility. The crib attendant may be called upon to carry out the following duties:

(a) Issue tools in exchange for requisitions or tool checks. (See Figure No. 133.)
(b) Inspect tools returned for damage, bluntness or other disability.
(c) Report on such damage or deterioration.
(d) Ensure correct storage and control of all tools and the follow up of tools which are outstanding without good cause.
(e) Mark all tools and correctly record their location.
(f) Compile all necessary records, including those required by the cost accountant in relation to charging out tools to the correct jobs.
(g) Advise the toolroom executive of all tools which require replacement or supplementing.

4. *Maintenance of Toolage.*

Tools should constantly and consistently be kept in good condition. The quality and the quantity of work may well depend upon, firstly the availability of tools when required and secondly the condition of those tools when obtained. Where there is an equipped toolroom, it is usually foolish to allow employees to carry out their own repairs. These should

FIGURE No. 134.

TOOLAGE RETURNED FOR MAINTENANCE.

Requisitioned for Production Order No............Date..................................
No. of Tool..Operator...........................
Machine No..Foreman............................

Particulars of Tool..
....
....

Returned for following Reasons :..
....
....

Maintenance Required...
....
....

be done in the toolroom, or at least as the result of a request received in writing from the toolroom. This will go a long way to ensure satisfaction with the condition of tools or at least will localise responsibility for poor toolage. In order to preserve this condition, it is essential that all tools be inspected immediately upon return to the toolroom. This is fundamentally important. Where the organisation provides tool kits for the employees constant and regular inspection should be made of the condition of those tools and repairs should be made wherever necessary. In some organizations, wherever toolage is returned before its work is finished a Toolage Returned for Maintenance Form must be completed. (See Figure No. 134.)

5. *Standardization.*

As much as possible, tools should be standardized. Standardization is often a difficult matter and is sometimes not welcomed by the works management. Nevertheless, it will be frequently found that this course will both promote efficiency by facilitating standardization, and will also effect considerable economies through a reduction in the quantity of tools needed and therefore of the value of such tools. Care should be exercised to see that a standard finally chosen is definitely the best that is available.

6. *Specification.*

Tools needed for each operation should be specified. The importance of this factor is true in virtually every case, but the exact method of operation may vary according to the type of work being carried out. Where repetitive operations are involved, for example, not only may the exact tools be specified, but instruction may be given as to how they should be used to secure the best results. In such cases it is obviously of the very greatest importance to give the closest attention to the selection of the best tools to carry out the work. In other types of work, this careful selection may not proceed to the same limits, but the specification of the tools to be used should be made by someone who has an expert knowledge of the work to be performed, what tools are available and what can be made. Usually this duty falls upon a capable toolmaker.

7. *Delivery.*

Tool delivery should be prompt. Much time and therefore money can be lost when tool deliveries are delayed. It is not only a case of the wages of the workman who is kept idle. What is much more important is that an expensive machine may also be idle and even more important still is the fact that machine loading plans are upset and possibly delivery dates will not be adhered to. Usually workmen receive tools in one or more of the following ways:—

(a) They attend the tool crib and ask for them.

(b) Required tools are sent to the operator requiring them.

(c) A combination of the two methods, some being issued as standard tools and special tools being called for by the operator.

8. *Requisitioning.*

Tools should be adequately accounted for. It is highly desirable that the location of all tools be known to the person in charge of the tool crib and in order to ensure this it may be necessary to see that full records of all tools are kept. These records will vary in different plants. The three main methods of controlling the issue of tools are:—

(a) The receipt method.

This involves obtaining a written receipt from each workman for all tools supplied. This is usually done when a kit of tools is issued. The tools included in the kit are listed and a signature obtained for the whole of the tools embraced in the kit. The method may, however, be cumbersome in relation to other issues.

(b) The check system.

This involves the issue to workmen of a number of checks, one of which must be handed over in exchange for each tool. This check is then placed in the space previously occupied by the tool which has been handed out. Sometimes the checks are numbered on the back—1, 2, 3, 4, 5, 6; so that if 3 tools of the same kind were required, a check with 3 on it would be exchanged. The disadvantage here is that as the check is placed where the tool was kept, the tools taken out by an operator are not known except by going through the whole of the metal checks which, would, of course, have the operator's clock number on them. This disadvantage can be overcome firstly by the use of a signature as well as a check, these signatures being kept in operator numbers, or alternatively, the use of double checks, one being placed where the tool was kept, the other being kept in operator number. The check system is not without weaknesses inasmuch as (1) old tools can be handed back when new ones are taken out, (2) the operator may allege he has lost the tool as full payment is not often demanded and (3) checks are sometimes put in the wrong place and cause all kinds of difficulties.

(c) Triplicate slip system.

With a triplicate slip system, a tool requisition is made out in triplicate. The first is put into a clip covered by the workman's number, the second into a clip covering the tool taken, and the third is retained by the man as his record. When the tool is returned, both slips are returned to the man.

9. *Responsibility.*

Workmen should be held responsible for all tools taken. One of the reasons for keeping adequate check over toolage is to see that where workmen lose or negligently break tools, they are held responsible for them. Only by this method can carelessness or something worse be minimised.

Usually a certain amount of consideration is shown where the operator is not seriously at fault, but it is necessary to insist as a principle upon the responsibility of the employee.

10. *Performance.*

Adequate records of performance and cost should be kept. Whilst no additional burden should be placed upon the toolroom staff, it is essential and important that adequate records should be kept showing the performance of tools and the cost item to which toolage should be charged. This is the point which most particularly affects the cost accountant. Very often it will be found by the cost accountant that cooperation with the toolroom staff will result in additional information becoming available to him which will enable him to spread his tool cost charges more accurately, and incidentally may result in economies in the annual charge for toolage.

Very often a card system is instituted to keep a record of all tools. This usually works on the same principle as an ordinary stores ledger, and if need be entries covering the incoming or outgoing of every tool can be recorded. These cards are, of course, of the utmost value when an inventory must be taken, but in addition they can be used to great advantage in the control of repairs and replacements of tools. If cost of repairs is inserted on the card, those tools which necessitate costly maintenance can be easily segregated. Furthermore, a study of the information contained on the cards may well be the means of reducing—sometimes considerably reducing — the total value of tools on hand. These may easily become up to 50% larger than is necessary for efficient production. One of the surest ways to facilitate a reduction in the tools held is to see that these are returned promptly after being used. A lesser stock may then be carried. Furthermore, prompt return means that there is less likelihood of the tools being damaged and more time is given to the tool department to see that they are adequately maintained and kept in order. Expensive tools which are required by more than one department are sometimes duplicated where there is more than one tool store. This can sometimes be avoided by having a central section for such expensive tools.

11. *Design.*

If at all possible, the tool room staff, not the production staff, should design all tools. This may not always be possible, but in nearly every case it is highly desirable if practicable. The toolroom staff (particularly if due care has been taken in their selection) tend to become expert in their work and such specialised knowledge should be used.

Advantages of Tool Control.

These may be summarized as under:—

1. Maintenance of quality of product.
2. Economy through lower cost of operations.
3. Economy through elimination or reduction of delays.
4. Economy through reduction in cost of tools.
5. Economy through reduction of inventories.

Control of Tool Costs.

If the cost accountant wishes to reduce the cost of toolage, it may be advisable to investigate the following factors:—

1. Can tools be returned more quickly ?
2. Can tools which are no longer suitable for one department be used by another ?
3. Can the men be encouraged to obtain their own tool kits ? (Even if the organisation decides to finance these.)
4. Can the tool inventory be reduced ?
5. Is obsolescence an important factor in the toolage ?
6. Are constant checks made against toolage previously used on production now discontinued ?
7. Are the tool control methods adequate ?
8. What losses are incurred through breakage, theft, etc. ?
9. Can a bonus scheme be arranged to encourage care with toolage ?
10. Can each department be placed upon a toolage budget ?

CHAPTER 40.

QUALITY CONTROL.

Importance of Quality Control.

It has already been indicated that the cost accountant has an interest in Production Planning and his duties are often affected by those functions. In an even more direct way, his work is affected by quality factors within an organisation, particularly as those factors manifest themselves in the quality and the cost of the product.

The figures prepared by the cost accountant frequently show the effect of quality on costs and it may well be part of his duties to set forth for the information of management periodical statements showing the proportion and value of scrap and spoilages. (See Figures Nos. 115 and 135.) Alternatively his statement may show the proportion of total output represented by firsts, by seconds, by thirds and other production. (See Figure No. 116.) Again he may show by a graph when quality drops below a certain standard. (See Figure No. 136, p. 553.)

The importance of the quality factor can perhaps best be shown by the following simple example of the effect of quality factors upon cost.

Assume the production of 1,000 dozen articles at a total cost of £1,000. The selling price of firsts is 30/-, of seconds 20/- and thirds 12/6 per doz.

If the whole production was firsts, the profit would be:—

Selling Price—1000 dozen @ 30/-	£1,500
Less Cost	£1,000
Profit	£ 500

If, however, only 700 dozen was firsts and 200 dozen was seconds, with 100 dozen thirds, the position would be:—

Selling Price—			
Firsts, 700 dozen @ 30/-	£1,050		
Seconds, 200 dozen @ 20/-	200		
Thirds, 100 dozen @ 12/6	62	10	0
	£1,312	10	0
Less Cost	£1,000	0	0
Profit	£ 312	10	0

Definition of Quality Control.

Quality control may be defined as the control of a product exercised to ensure the product conforming to all specifications. The control of quality is essentially one of a control of variables. Raw materials are primarily derived from nature and therefore vary. They are processed by men with machines and in certain manufacturing conditions — all these representing variables. Men differ in skill, in knowledge and in attention to detail; machines differ in accuracy and consistency; manufacturing conditions vary in countless ways and even from day to day. Quality control is therefore the control of these variables in such a way

FIGURE No. 135.

DEPARTMENTAL SPOILAGE REPORT.

Production Order No........................... Date..............
Part No..........................Description of Part..
Operations Completed.........Operation Spoiled.................Inspector....................
Man Responsible................Dept. Responsible.................Date Inspected............

Description of Fault.	Cause of Fault.

Cost to Date ....
Estimated Scrap Value.........................
Treatment Recommended...
Delivery to...

as to ensure as many of these as possible being brought within the demands laid down by a specification. The degree to which these variables are controlled shows itself in the final quality result. If the variables are not well controlled, the quality result is bad. If they are well controlled, the result should be good.

It should therefore follow that one of the most important factors in quality control is to see that the number of variables is reduced to the lowest possible number. Unfortunately, many of these may be outside the control of management — they may be uncontrollable variations. Nevertheless there will always be others which can claim the attention of management.

Quality control, through the control of the variables seeks to:—

1. **Maintain an acceptable standard of quality throughout the operations of the factory, and in the final product.**
2. **Locate the sources of defective work and through such location, enable responsibility to be fixed.**
3. **Provide information which will increase quality or reduce expenditure.**

The chief problems involved are:—

1. **The setting of the specification and the standards.**
2. **The development of methods to be applied to determine quality reached.**
3. **Procedure for checking accuracy.**
4. **Organisation for quality control.**

In order to carry out these functions certain essentials must be recognised:—

1. A clear definition of the quality standards to operate.
2. Adequate facilities and organisation to manufacture the product.
3. Methods of measuring the product with the predetermined standards.

Two other factors are often associated with these, viz.:—

1. Use of a bonus scheme based on quality results.
2. Methods of dealing with or reclaiming scrap or low quality goods.

Quality Standards.

Quality standards are usually laid down through drawings and, particularly, specifications. The specification sets out the characteristics of the finished product and, depending upon the particulars and type of product, the specification may be short or may be a long involved document. Apart from the dimensions and tolerances shown, to which the product in its final form must subscribe, standards relating to the following may be laid down:—

1. Strength.
2. Hardness.
3. Fineness.
4. Finish.
5. Texture.
6. Colour.
7. Flavour.
8. Odour.
9. Tone.
10. Stability.
11. Dimensional accuracy.
12. Purity.

Quality specifications obviously differ in the case of different products. With a food product, for example, the fundamental requirements may be colour, flavour, odour and purity. With a fabric, they may be texture, colour, and weight. It is not always easy to express the quality characteristics in a definite form. Sometimes quality, for example, is best judged by taste as in the case of tea and butter. Thus, where specific directions cannot be given, quality may be dependent upon the personal judgment of the inspector. Wherever possible, however, the specifications in relation to quality should be clearly and definitely laid down. Only by such means can quality be maintained and argument and recrimination avoided. The war has thrown into relief the importance of quality and it is probable that inspection under rigorous standards has made enterprise more quality-conscious. In engineering, it is frequently found that an ideal arrangement is set down but, recognising that perfection is very often too costly, certain variations are allowed. These are referred to as "tolerances" and they represent the permissible variations from the ideal laid down. They are a compromise between what the customer will accept and the law of diminishing returns.

Adequate Facilities.

Manufacturing facilities can play a most important part in quality control. Accurate and efficient tools will help to obtain accurate and efficient work. Careful selection of materials and the checking of incoming materials with the relevant specifications will avoid the acceptance of inferior products. Complete drawings will help operators to achieve accuracy whilst factors left to operators' judgment may well cause losses. If machines have been neglected and repair work not carried out, an additional difficulty is placed upon operators in their attempts to maintain the specifications laid down. Where operators are asked to work on very fine tolerances for example, accurate machines are essential. In addition, workers must exercise due care and should have been thoroughly trained for their work. Automatic machines have lessened the degree of dependence upon the worker (the variable of the workman) but basically, it is still the worker who must in the final analysis control quality. Frequently the standard of work is affected by the conditions within a plant. If conditions are very trying, the quality of the work may suffer badly. Furthermore, different conditions within a plant may affect products in different ways. Excessive humidity in a woollen mill may be almost an advantage. In a furniture factory it may be troublesome. Cleanliness is desirable in an engineering shop, but it is fundamentally imperative in food processing.

Inspection.

Apart from the usual operating precautions which should be taken to ensure satisfactory quality, it is usual to find that a separate section is set up to examine the product, either when it is completed or at certain stages in its production. These functions are usually referred to as Inspection. In this connection certain fundamental considerations should be observed:—

1. Wherever possible Inspectors should be independent of those whose work is to be checked.
2. The functions of inspection should be co-ordinated and brought under unified control.
3. Inspection staff must be adequately trained and should be given all necessary facilities for carrying out its work.
4. Methods and procedure of inspection must be in harmony with the product and the processes being covered.

The function of inspection is extremely important and the work should be carried out without fear or favour yet with fairness and a due regard to all factors affecting the issue. The exact place which inspection should take in an organisation depends upon the conditions operating. In some shops, the inspection section may be under the works manager, in others it may be under the general manager. It is important to see at all times, however, that an inspector is not asked to accept or reject the work of an officer to whom he must report. He should wherever possible be given the status of an independent officer and led to regard himself as such.

Inspection functions should not be left to grow haphazardly, but should be properly planned. The functions often commence with raw material and continue through to the finished product. This involves decisions as to the stages at which inspection will be carried out.

Specifications for the quality standards may be laid down by different sections of an organisation. They may be the result of a specification drawn up by the customer. They may be prepared by the chief draughtsman, by the chief engineer, by the sales manager, or may be the result of collaboration on the part of all three.

The duties of an inspection department may be laid down as:—

1. Inspection of everything necessitated by the specifications of the products—including raw materials, processes, finished product.
2. Inspection of all tools and gauges—both those used in production as well as those used by the inspection department itself.
3. Supervision of all work associated with inspection such as greasing, wrapping or packing.
4. Partial, joint or complete supervision and/or control of all salvaging work.

It should be remembered that inspection is very often only as good as its weakest inspector.

In deciding what and how to inspect, concentration should be made upon the following:—

1. The elimination of variables and therefore should be made as close as possible to the source of the variables.
2. Those places where any failure would be either costly or serious from another angle—such as delay.
3. Those operations which are the forerunners of a large number of other operations, not inspected.
4. Those processes which, when completed, cover up the weaknesses of previous operations.
5. Those points where responsibility can be fixed.

Other factors affecting inspection are:—

1. Whether products are rough and crude (little inspection being necessary)—or fine, (much may be essential).
2. Whether tolerances are fine or otherwise.
3. Whether models are changed frequently.
4. Whether labour is skilled or unskilled and whether it changes rapidly.
5. Whether quality standards are being raised.
6. Whether standards have been reduced to a definite measurement basis.

Inspection can be carried out (1) in the premises of the vendor or (2) in the premises of the buyer.

Inspection within a plant can be carried out "on the floor" or can be centralized. The former allows of the advantages attaching to a roving commission, the latter may be more thorough and must be carried out where delicate equipment is necessary. The latter has the disadvantage of necessitating all parts being removed to the inspection room, bay or benches.

Inspection may take different forms and the type and degree of inspection is a matter for individual determination depending upon all the characteristics of the organisation and its production activities. For example, it may take the following forms:—

1. End result inspection.

In this case, inspection of the final product would be made and if found to be satisfactory, the product would be passed. Even in this case, however, there may be variations because every product may be inspected or only certain products taken at random (usually referred to as sampling). If sample inspection shows an inordinate amount of rejects, usually the whole batch is carefully inspected. Very often, sample inspection is used for intermediate operations and a complete inspection for the final assembly. The cases where sampling is sufficient should be carefully considered. Obviously if the product is important and is to be used in connection with other products, it may be necessary to inspect every product. On the other hand if the product is relatively unimportant, only a few may be inspected. Usually, where all products are covered, inspection has as its main object the utility value of the products, as, for example, with valves. If a valve is not tested before being sold there would be no definite guarantee that it would work. In such a case, inspection is conducted, even outside the factory. If an electric light globe is purchased, for example, it is usually tested by the retailer before being sold to the customer. Where sampling is carried out, the object is usually to keep check on the general quality so as to ensure that a reasonable standard is being continuously attained.

2. In process inspection.

Some inspection is usually carried out whilst the work is in process. This varies in extent from the shop where every operation is 100% inspected to the casual inspection of some processes or the inspection of the "first off." Where the product is either of the utmost importance or of great value, it may not only be practicable, but essential that every operation be inspected. Indeed, every component may be inspected as it comes off the machine. In such cases, an inspector usually sits alongside the operator and checks the component the moment it is finished. Obviously, this procedure must be adopted where components are assembled into, for example, a gun, which, without inspection, may prove to be faulty because of one small part. In some cases, particularly with dilutee labour the first few components finished may be inspected to see that the operation is correct. With automatic machines, it may then be possible to feel reasonably sure that succeeding components, at least up to a certain number, will be acceptable.

3. Complete inspection.

Particularly in war time, it is often necessary to see that inspection is carried out in such a way as to cover not only 100% inspection in the factory, but also inspection and tests of the raw material in the first instance. All kinds of metallurgical tests may be necessary and rigid specifications covering raw materials must be checked and certified to. Total inspection is then carried out so that when the product is finally complete, the only possible error would arise from lax work on the part of the inspector. Obviously when dealing with explosives or something which may endanger the lives of large numbers of men, no inspection can be too thorough.X

X Mechanical Aids.

All types of mechanical aids have been developed for use by inspectors though it is held by some good judges that inspection equipment has not developed as fast as production equipment. Some machines used are very costly and extremely intricate. The main standby of the inspection section is, however, the gauge. The American Engineering Standards Committee defined a gauge as "a device for determining whether or not one or more of the dimensions of a manufactured part are within specified limits." In manufacturing, three types of gauges may be prepared:—

1. Master gauges—those with which all others are compared.
2. Inspection gauges—those used by the inspection section.
3. Working gauges—those used by the production operatives, foremen etc.

As with so many other factors in production and management, the law of diminishing returns applies also to inspection. There comes a time when an extra amount spent does not return comparable savings. Whilst it should be adequate, inspection should not be carried to this stage.

Inspection Personnel.

Because of the importance of the work and the integrity demanded in carrying out the functions, inspection staff should be carefully selected. In addition to moral characteristics, it is necessary to ensure that those chosen have a first class knowledge of the work which must be inspected. The duties often call for (1) high degree of technical knowledge, (2) an intimate knowledge of the products manufactured, (3) a close acquaintance with the various machines being operated, (4) a complete knowledge of the machines and devices used in inspection.

Bonus Schemes to Promote Quality.

Recognising the importance of maintaining a high standard of quality, some organisations have arranged for bonuses to be provided in recognition of quality. These schemes are usually based upon certain quality standards, and if the employee reaches or betters those standards, certain prearranged bonuses (sometimes progressively increasing) are paid. These bonuses may be given for individual work or alternatively may be group bonuses where the work of individual employees cannot be kept rigidly separate.

In certain industries, rather than a bonus being paid for good work, a penalty is imposed for work which is not up to standard. The obvious instance is where a piece work rate is in operation, the employee being paid only for work of a required standard. In such a case, the employee may receive no payment for inferior work.

Reclamation of Inferior Work.

One of the necessary accompaniments of quality control is the treatment of inferior work. This may take the form of (1) excessive scrap, which may simply be sold, (2) waste which may be discarded or, as in certain industries, used for waste products, (3) inferior work which by special attention may be turned into acceptable goods or goods of higher grade (See Figure No. 135.) It is very advisable to have a well-defined policy to cover the reclamation of inferior work. Where there is no such policy, large amounts may be wasted in scrapping products which, with a little attention, could be saved or increased in value.

Usually it will be found advisable that good operatives be placed on reclamation work. It often calls not only for skill, but for knowledge and judgment. Some organisations, therefore, place their best operatives within this section. It should be remembered, however, that nowhere is the old adage "Prevention is better than cure" more applicable than in the avoidance of waste and spoilages.

Measurement of Defective Work.

Ratings of defects are given by Hall in "Quality Control" Manufacturing Industries, Vol. XVI, No. 1, pp. 17/19. These are shown as:—

"1. Very serious. Would cause operating failure of the unit in which it was included.

2. Serious. Would probably, but not certainly, cause failure of the unit. Would surely cause operating difficulties and involve increased maintenance costs.
3. Moderately serious. Might cause operating failure. Likely to lead to " below standard " operation, increased maintenance, or diminished life. Includes major defects in finish or workmanship.
4. Not serious. Would not cause operating failure. Minor defects of appearance, finish or workmanship."

"A relative weighting can be given to these defects, by assigning demerit points of 100, 60, 25 and 5 respectively, to the several classes. Then the number of defects in each class multiplied by the demerit points for each defect give a total of demerits in any period for the class.

In a certain case, the figures for a base period of five years were worked out as shown by the following tabulation. The total of the demerit points was 43,500. Assuming that 100,000 pieces were inserted in the period, the demerit points per unit would be:—

$$\frac{43,500}{100,000} \text{ equals } 0.435.$$

Quality Demerit Calculations.

Class of Defect	*Number of Defects*	*Demerits per Defect*	*Total Demerits*
A	50	100	5,000
B	100	60	6,000
C	1,000	25	25,000
D	1,500	5	7,500
Total Defects	2,650	Total Demerits	43,500

When a table has been compiled for the work of a current month, an index figure can be set up to correlate the two efficiencies. If the figure found for the current month was 0.075, then:—

$$I \text{ (Index) } \frac{\text{Current demerits per unit}}{\text{Base period demerits per unit}} \; \frac{0.075}{0.435} = 0.17$$

When I is unity the two efficiencies are equal. If no defects were found in the current month, I would be zero, which would indicate perfection. When I is less than unity, improved work is indicated. When I is greater than unity, current work of a poorer quality than in the base period is indicated."

X Results of Quality Control.

Some concerns sell their product upon one basis only—quality. Furthermore, the price which can be obtained for high quality goods is sometimes so much higher than for ordinary quality that the extra manufacturing cost involved is considerably outweighed.

Quality control results in:—

1. Greater uniformity of product with more dependable quality.
2. Scrap problem being brought under control.
3. Percentage of scrap loss lessened.
4. Costs of production reduced.
5. Greater interchangeability of parts.
6. Greater service to customer.

In "The Control of Quality in Manufacturing" (G. S. Radford) the following statement appears—"The positive and continuous control of quality to definite standards within limits and at all stages of manufacture is at the root of production economy." The significance of that statement should not be lost upon the cost accountant. X

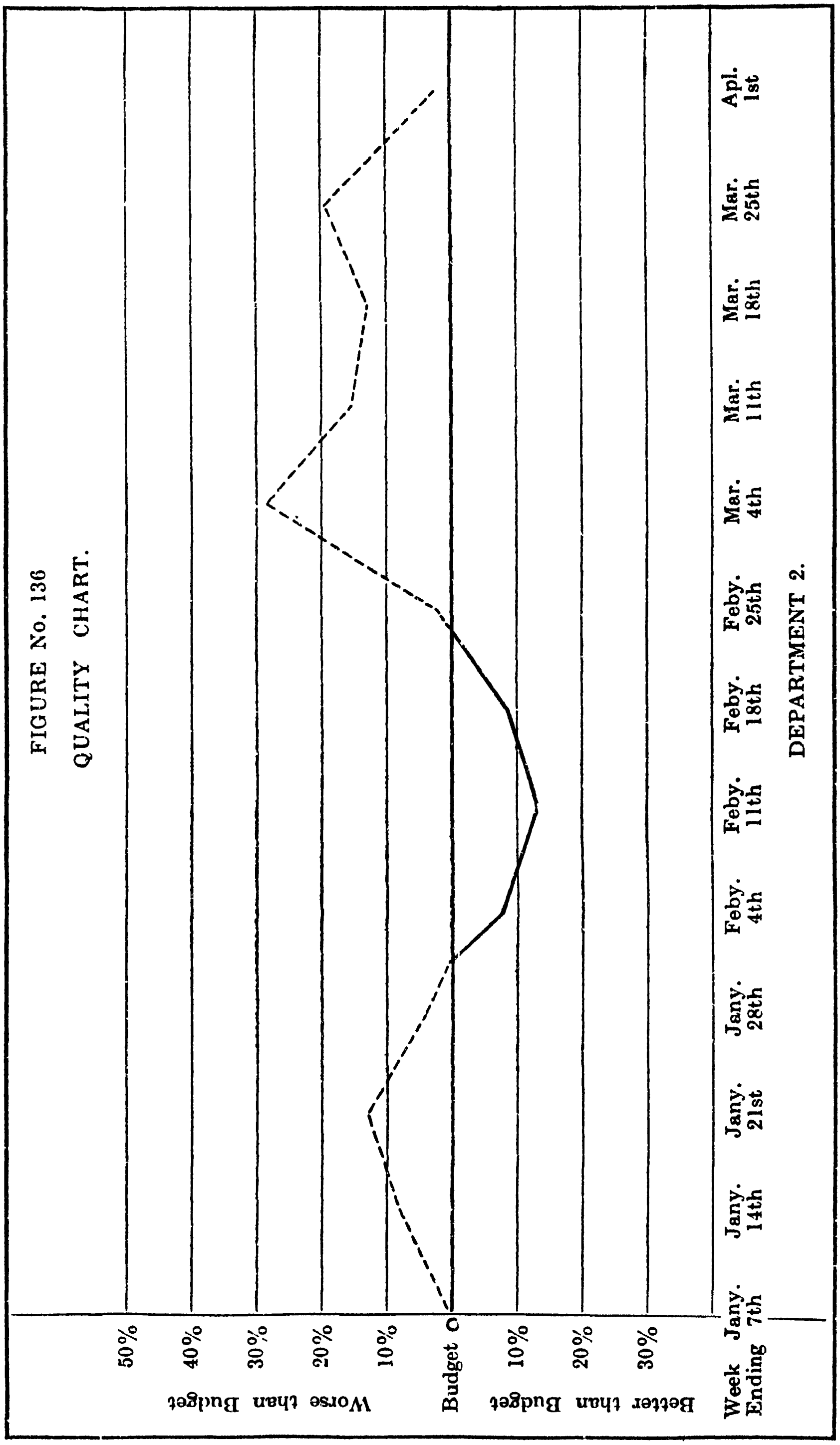


FIGURE No. 136

QUALITY CHART.

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